Efficacy of Mouth Care Education to Improve the Oral Health of Residents of Long Term Care Homes

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Abstract

Objective: To assess the efficacy of personal support worker (PSW) mouth care education to improve the oral health of residents of long term care homes.

Methodology: Experimental PSWs received mouth care education at baseline before taking the knowledge test. PSWs’ mouth care knowledge was measured using a 20-item knowledge test at baseline, post-test (supervised); 6-months (un-supervised). Residents’ oral health outcomes assessed at baseline and 6-months using the modified Plaque Index and modified Gingival Index.

Results: Experimental PSWs’ post-test knowledge (n=32; \(M=17.59; SD=1.43\)) significantly increased from pre-test (\(M=15.34; SD=2.10\)), \(F(2,72)=4.90; p<.05\). 39 control residents and 41 experimental residents participated. Experimental residents’ PI significantly decreased at 6-months compared to baseline, \(F(1,156)=5.52; p<.05\), there was no significant difference in their GI between baseline and 6-months, \(F(1,156)=3.29; p=.07\).

Conclusion: PSWs’ mouth care knowledge significantly increased after receiving mouth care education and was sustained over six months. Only experimental residents’ PI significantly improved after 6 months.
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Chapter 1
Introduction

Oral health is important for the daily function of the mouth such as chewing, speech, and even an individual’s self-esteem. Moreover, oral health is associated with several aspects of general health, including respiratory diseases, diabetes, and cardiovascular disease. The ability to perform effective oral hygiene is essential to achieving optimal oral health. Consequently, for individuals who are unable to perform effective and adequate oral hygiene, oral health can deteriorate as a result. Poor oral hygiene can result in increased incidence of oral diseases such as caries, gingivitis, and periodontitis and may lead to tooth loss. Epidemiological oral health surveys have often described the oral health of residents of long term care homes as poor. Factors such as physical/mental disabilities and frailty due to advanced age or chronic illness make it difficult for some residents of LTC homes to maintain daily oral hygiene. Furthermore, lack of motivation, low perceived oral health needs, pre-existing attitudes and expectations regarding overall health and oral health, and lack of support from care staff are additional factors that can contribute to poor oral hygiene among residents of LTC homes. Poor oral hygiene and the resulting oral diseases contribute to the poor oral health status of residents of LTC homes. Furthermore, there is evidence to show that there is a relationship between poor oral health and decreased general health status and may negatively impact quality of life.

1.1 Statement of the problem

Individuals are often admitted into LTC homes due to a certain degree of loss of functionality. Simply stated, these persons are unable to take care of themselves, and require some level of assistance from care staff with activities that are commonly referred to as Activities of Daily Living (henceforth referred to as ADL) Depending on the degree of disability, the level of
assistance dependency ranges from minimal to complete. Thus, due to physical and/or mental impairments, residents of LTC homes often must rely on care staff for assistance with their ADL, which include daily mouth care.

Numerous studies have highlighted the barriers to optimal oral health encountered by residents of LTC homes. These barriers include the staff’s lack of time to perform daily mouth care, staff’s low prioritization of daily mouth care compared to other daily duties, lack of managerial/organizational support, fear of performing mouth care, lack of resident cooperation, and lack of resident interest in their own daily mouth care. Specifically, some qualitative studies have identified lack of knowledge and training regarding mouth care provision among LTC support staff as a significant barrier to good oral health among residents of LTC homes. However, few studies have assessed the efficacy of these training programs (the intervention) in terms of their impact on the oral health of residents of LTC homes. Currently, little is known regarding the effectiveness of these educational interventions to improve the oral health of residents of LTC homes.

1.2 Purpose of the study

The purpose of this study is to evaluate the efficacy of a Mouth Care Education Program, as presented to support staff of LTC homes, to improve the oral health of residents of LTC homes. This study will investigate (1) the efficacy of the mouth care education program to improve the knowledge of support staff regarding mouth care provision, (2) the retention of support staff’s knowledge regarding mouth care after six months, and (3) changes in residents’ oral health outcomes after six months in those LTC homes where mouth care education was provided.
1.3 Significance of the study

Studies have been conducted to measure knowledge levels regarding mouth care provision following mouth care education.\textsuperscript{23,32} However, few researchers have tested the efficacy of these mouth care educational and training programs to improve the oral health status of residents of LTC homes.\textsuperscript{30,33} This study will contribute to the limited body of knowledge regarding oral health and mouth care education intervention for residents of LTC homes. The results may influence the feasibility and logistics of presenting future mouth care educational programs in the format that they are currently available in the LTC setting.

1.4 Definition of terms

LTC – long term care (homes)

PSW – personal support worker

ADL – activities of daily living

PI – Plaque Index

GI – Gingival Index

Xerostomia – an oral condition commonly known as “dry-mouth”

OHRQoL – Oral Health Related Quality of Life

Mouth Care – daily oral hygiene protocol which may include toothbrushing, denture cleaning, and/or oral inspection.

Edentulous – complete loss of teeth

Baby Boomer – those individuals born in the two decades after World War II

Caries – dental cavities
Chapter 2  
Review Of The Literature

2  
Review of the Literature

2.1  Demographics

According to the latest Statistics Canada Census (2006)\textsuperscript{34} there were over 4.3 million people over the age of 65 in Canada. This represented a record 13.7\% of the total Canadian population in 2006, almost double the percentage of 65-year-olds and older in 1966, at 7.7\% or 1.5 million.\textsuperscript{34} Current Canadian population projections predict the senior population to nearly double again in the next 25 years, from four million in the year 2000 to around eight million by the year 2026.\textsuperscript{34} According to this projection, the number of Canadians over the age of 65 years will account for 21\% of the population by 2026. In addition, the most rapidly increasing segment of the senior population occurred in the 80-years and older cohort, surpassing one million in 2006 for the first time in Canadian history. As the Baby Boomer generation ages in the next 25 years, in addition to an increase in life expectancy, the increase in the elderly population will have a significant financial impact on the health care system as they seek medical attention for the myriad of age related health issues.\textsuperscript{35,36} This increase in the 65 years of age and older population is not unique to Canada. Most Western industrialized nations are seeing similar growth trends in this population demographic.\textsuperscript{6,12,27,37-40}

2.2  Long term care in Canada

In Canada LTC homes are licensed by provincial or territorial regulatory bodies. According to the latest release from Statistics Canada\textsuperscript{34} there were 1,873 residential homes caring for 157,498 residents, with an average of 84 beds per home. These statistics exclude the province of Quebec.
Although minor differences exist between the provinces, in general LTC homes are classified into three categories. Type I level of care is care provided to persons who are ambulatory, but who may have decreased physical and/or mental faculties and thus require only minimal supervision and/or assistance with their ADL. Type II level of care is provided to persons with relatively stabilized chronic disease (physical and/or mental) or functional disability who require medical and professional nursing. Type III level of care provides 24 hour professional assistance to persons with chronic illness and/or functional disabilities, both physical and/or mental. This care can include a range of therapeutic services, medical management and skilled nursing care.\textsuperscript{41} With a predicted increase in the elderly population, there is also a predicted increase in the number of elders that will utilize services offered in LTC homes.

2.3 Resident dental profile

The dental profile of the elderly population is changing, with more persons accessing LTC homes presenting with more retained teeth than in previous generations.\textsuperscript{42-44} In a Canadian survey of 369 elderly residents of LTC homes, Wyatt\textsuperscript{42} reported a mean number of teeth per resident of 16.4, with almost three quarter of the residents retaining teeth in both arches. More recently, in a longitudinal survey of the elderly residing in Sweden, Osterberg\textsuperscript{44} reported that the percentage of dentate Swedish elderly increased from 49\% in 1971 to 93\% in 2001. Moreover, there was a marked increase in the proportion of elderly with 20 or more teeth, from 19\% (in 1982) to 65\% (in 2001). This data reflect a decrease in the prevalence of edentulism in the elderly population.\textsuperscript{44,45}

There can be many reasons leading to a person being admitted into a LTC home, with the most common being provisional palliative care. This includes individuals who are transferred from acute hospital care, or those with decreased functional capabilities as a result of advanced age or
the onset of diseases (such as Alzheimer), all of which require some level of professional nursing care. Consequentially most residents of LTC homes present with challenging health issues in addition to physical and/or mental disabilities that impact their abilities to perform their activities of daily living, including the ability to perform oral hygiene. Moreover, most residents are on a polypharmacy therapy, with many of the medications having a negative impact on the oral cavity, most notably xerostomia.

Wyatt in a survey of LTC residents revealed that almost all subjects had been diagnosed with at least one serious medical condition. In addition, almost all subjects were taking prescription medications for these medical conditions, with over three quarters taking medications that produced xerostomia as a side effect.

In a survey of residents of the Department of Veterans Affairs (VA) LTC homes, Weyant reported prevalent disease categories that impact the provision of oral hygiene, including sensory loss, dementia, psychotic disorders, and diabetes. The most frequently prescribed medications recorded all had dry-mouth side effects, including antihypertensives, and antipsychotics.

Carter et al. in a New Zealand study found that almost all subjects (89%) were under hospital care for health-related illness and that, on average, each subject was on 9 different prescription medications. Most subjects were completely edentulous and were wearing dentures. Seventy-five percent of subjects did not clean their own teeth and/or dentures and relied on the LTC home support staff for oral hygiene and denture care. The oral health of these dependent residents was poor, including high caries prevalence among the dentate subjects, and high treatment needs recommended for most subjects. Many of the mucosal infections were believed to involve Candida, although no laboratory microbial analysis was performed. The authors found that there
was a significant relationship between xerostomia, denture wear, poor oral health, and multiple medications and the reported Candida infections.

2.4 Oral health status

The oral health status of LTC residents has often been described as poor due to a lack of oral self care and/or assistance from LTC support staff. A literature search on Medline using the keywords “nursing homes,” “long term care,” “oral health,” and “seniors” and related links resulted in an overwhelming number of studies supporting this finding. The following sections describe some of the most common oral health conditions affecting residents of LTC homes.

2.4.1 Xerostomia

Saliva has several functions within the oral cavity. It acts as a lubricant that coats foods within the oral cavity, thus aiding the physical chewing and swallowing of food. In addition, salivary enzymes also help in the initial breakdown of food as part of the digestive system. This initial breakdown of foods within the oral cavity also enhances the taste and enjoyment of foods. Difficulties encountered during eating will affect the nutritional food choices an individual make. Saliva also acts as a chemical buffer against bacterial acid attack on dental hard tissues (enamel and dentin), protecting them from the development of coronal and/or root caries. Xerostomia is a condition characterized by decreased production of saliva which results in the affected individual experiencing a dry mouth. Persons with dry mouth often have oral-related complaints such as difficulty in chewing, swallowing, mouth pain, altered taste buds, and speech difficulties. Xerostomia is often seen in individuals taking certain medications and/or mouth breathing. Some of the most frequently prescribed drugs have oral implications, including xerostomia. In addition, certain diseases such as Sjogren’s syndrome have xerostomia.
manifestations. Xerostomia frequently affects residents of LTC homes and is often associated with the prolonged usage of prescription medications.\(^4,5\) The prevalence of xerostomia seen in LTC residents ranges from 10% to as high as 75%.\(^6,4,13,50,51\) Xerostomia increases in those residents taking more medications than those taking less medications.\(^50\) There is inconclusive evidence linking xerostomia to healthy, unmedicated adults. That is, xerostomia is not a natural part of aging in healthy, unmedicated individuals.\(^47,48\)

Xerostomia can be measured biometrically or subjectively. Biometric measurement of salivary flow often involves the collection of a quantity of saliva over a period of time and is then reported as a flow rate.\(^51\) A person is classified as having xerostomia when the resting saliva flow rate is below 0.4 ml/minute.\(^51\) Subjective measurement of xerostomia often involves using questionnaires or interviews that record subjects’ perceptions of dry mouth.\(^4,50\)

In a Swedish study of 161 subjects in an elderly rehabilitation ward, Andersson\(^6\) reported that the most common oral health problem among subjects was low saliva flow. Low saliva flow in this study was measured using the Revised Oral Assessment Guide (ROAG), developed for use by professional support staff (e.g., nurses) to assess oral health status. The quantity of saliva flow is measured by sliding an intraoral mouth mirror along the buccal mucosa and assessing the degree of tackiness between mirror and mucosa. Thus the ROAG does not attempt to record the subjective assessment of xerostomia as reported by study subjects. In this study, subjects with significantly lower salivary flow had difficulties in swallowing.

Likewise, Gerdin\(^4\) in a survey of 41 randomly selected participants reported a high rate (44%) of dry mouth. This study incorporated both saliva collection, and a questionnaire to assess subjective dryness of the mouth as reported by study participants. Subjective dry mouth was significantly associated with items on the oral health-related quality of life questionnaire (OHIP
or Oral Health Impact Profile) such as *trouble pronouncing words, sense of taste has worsened,* and *has been irritated with other people.* This study demonstrated that objective and subjective dry mouth conditions negatively affect oral health-related quality of life in the frail elderly population.

Similarly, Locker⁵ in a survey of 225 residents of a LTC home reported a dry mouth prevalence of 31% using a self-report questionnaire. In addition, there was a significant association between degree of xerostomia and the use of prescription medications and that xerostomia was strongly associated with the measures of oral health-related quality of life used in this study.

In contrast, an earlier survey by Kiyak et al.¹³ reported only a 10% rate on xerostomia in a LTC residential population. In this study, participants were only asked whether they had recently experienced problems with dry mouth. One possible explanation for the low reported prevalence of dry mouth in this study was the subjective assessment of dry mouth among a population that has been documented to have low perceptions of health and health expectations.²⁵

Thus xerostomia can not only adversely affect the physical health and function of the mouth, but may also negatively impact the oral health-related quality of life of the individual by affecting the enjoyment of food. Xerostomia has been frequently described in the oral health of LTC residents.²,⁴,⁵,⁶,⁴²,⁵²,⁵³

### 2.4.2 Candida

Candidiasis, commonly known as thrush, is mainly caused by the colonization of the oral cavity by the opportunistic yeast *Candida albicans,* although other species have also been identified.⁵³

It is important to mention that *Candida albicans* is a natural part of the oral microbial flora.

Thus an overgrowth of Candida and the resulting mucosal manifestation of candidiasis represent
a source of infection and/or the host’s immune response. Some of the most frequently cited risk factors associated with the development of candidiasis include xerostomia, tobacco use, wearing ill-fitting dentures, poor oral hygiene, poor general health, and antibiotic therapy. The prevalence of Candida albicans infection in LTC residents can be as high as 77% and seems to be positively related to the resident’s age and/or the number of current medications.

In a recent study of patients of hospital geriatric long-term care units, Grimoud et al. found most of the subjects were afflicted with serious medical illness for which they were taking prescribed medications. The most common of these medical conditions were mental illness, high blood pressure, diabetes, and cancer. The most common medications taken were psychoactives, anti-hypertensives, antineoplastic, and antibiotics, all of which had xerostomia side effects. In addition to requiring assistance with their ADL, over 60% of subjects were totally dependent on care staff for dental hygiene care. There was a high prevalence of candidiasis infection (43%) which was significantly associated with Candida albicans. Although there was no statistically significant association between candidiasis and the most common medical conditions, all of the subjects were in a state of deteriorating general health, which might have decreased their ability to fight off candidiasis. The results of the study showed that the development of candidiasis was related to the degree of Candida colonization. Hence, a decrease in the Candida colonization was associated with a reduction in the risk of candidiasis development.

2.4.3 Stomatitis

Stomatitis is an inflammation of the mouth. It is often found in cancer patients who are undergoing chemotherapy using anti-neoplastic drugs. Another form of stomatitis occurs under dentures, and is most frequently associated with the colonization of Candida albicans. As discussed earlier, an imbalance in the oral microbial flora can bring about an increase in the
colonization of Candida. In the LTC residential population, such contributing factors such as decreased immunity due to illness and/or advanced age, poor oral health, prolonged antibiotic therapy, and xerostomia can increase the risk for developing denture stomatitis.

In a study to evaluate the correlation between oral yeast, xerostomia, mucosal health at denture sites, and drug use, Kreher et al.\textsuperscript{53} concluded that there was a significant association between these variables. In particular, more than half of the subjects were taking drugs with xerostomia side effects, and that subjects taking two or more drugs with known xerostomia side effects had significantly lower salivary flow rates than those not taking drugs with xerostomia side effects. Candida albicans was also the most commonly implicated yeast species associated with denture stomatitis. In addition, twice as many smokers had denture stomatitis than non-smokers. The authors concluded that there was a significant association between C. albicans, nocturnal denture wearing, xerostomia, and increased use of drugs with xerostomia side effects.

In a survey of 31 LTC homes in Washington State, USA, Kiyak et al.\textsuperscript{13} reported significant oral health problems. Almost half of denture wearers had problems with loose dentures. Other high prevalences of poor oral health included sore and bleeding gums (43%), root caries (36%), coronal caries (26%), and xerostomia (10%). Among denture wearers there were significant problems related to stomatitis, including denture sores, dry mouth, and other soft tissue lesions. Interestingly, there were significant associations between the size of the nursing homes and the various aspects of oral health. In general, residents in larger homes had more problems with poor oral health such as bleeding gums, dry mouth, loose dentures, and soft tissue lesions.

2.4.4 Periodontal status

Periodontal disease affects the supporting structures of the teeth (referred to as the periodontium), including the gingiva, the bone supporting the teeth, and the surrounding
connective tissues.\textsuperscript{60,61} The degree of infection ranges from mild and localized to more severe types that can result in rapid loss of supporting bone and connective tissues. Included in the periodontitis classification is gingivitis, which is inflammation that is limited to the gum tissues. For certain individuals, untreated gingivitis can progress deeper into the periodontium resulting in periodontal disease. Clinical oral signs associated with periodontal disease (periodontitis) include gingiva that bleed upon probing, subgingival presence of calculus, and/or gingival pocket depth greater than three millimeters. Periodontitis is often caused by poor oral hygiene, but can also be mitigated by other factors such as systemic diseases, smoking, and malnutrition.\textsuperscript{62} If left untreated, the eventual destruction of the supporting structures surrounding the teeth often leads to teeth mobility and ultimately loss of teeth. The number of teeth lost can directly affect the ability to chew food, speech formation, and can negatively impact the oral health-related quality of life of an individual.\textsuperscript{63} Even though the incidence of retained teeth in the LTC resident population has increased,\textsuperscript{14} periodontal disease has become a more prevalent condition. Thus maintaining good oral hygiene in this particular population is the most important way to prevent periodontal disease and tooth loss.

Weyant et al.\textsuperscript{14} reported high prevalences of clinical signs that are associated with periodontitis among dentate residents of the VA LTC homes. One hundred percent of subjects had sites that bled upon probing, with over 70\% of subjects presenting with supra and subgingival calculus, and 60\% of subjects had pocket depths greater than 3 mm. However, only 7\% had pocket depths greater than 6 mm, possibly reflective of the “survival effect,” whereby teeth with advanced periodontal disease were extracted resulting in the remaining retained teeth exhibiting healthier conditions. This study utilized the National Institute of Dental Research (NIDR) Survey of Employed Adults and Seniors protocols. It was recognized that this methodology may
underestimate the prevalence of severe periodontitis since distal interproximal sites were not assessed. These findings are similar to others.12,27,64

2.4.5 Dental caries

The prevalence of dental decay in the LTC residential population is well documented in the literature, ranging from 50% to 100%.2,13,14,26,27,31,40,43,46,65 Moreover, the evidence also suggests that the prevalence of tooth decay in this cohort is greater than for the same cohort living independently in the community where the caries prevalence is around 20% and can be as low as two percent.66

In a clinical survey of residents of LTC hospitals, Wyatt65 reported 78.6% of residents with at least one carious lesion, and 68.8% of the residents with caries on the root surfaces of their remaining teeth.

Similarly, Carter et al.27 reported a caries rate of 65% among dentate participants in a clinical survey of LTC residents in New Zealand. These findings are similar to those of Hawkins et al.26 and Maupome et al.46

Residents of LTC homes are at risk for caries due to a variety of factors, including poor oral hygiene and the use of prescription medications that reduce saliva production and cause dry mouth. Saliva plays an important preventive function in the development and progression of tooth decay, acting as a buffer against the acidic demineralization of tooth enamel, the initial stage of tooth decay development.47

In a clinical survey of two cohorts of seniors in the United States, Kitamura et al.67 found significant relationships between root caries and oral hygiene, and between root caries and the number of medications residents were taking. In addition, those residents taking medications
that were known to cause dry mouth had significantly more root caries than those taking medications with no known dry mouth effects. The prevalence of root caries was significantly greater among LTC home residents compared to community dwelling residents.

2.5 Oral health-general health association

There is increasing evidence in the literature linking poor oral health to general health.\textsuperscript{8,17} Specifically, the microbiological and epidemiological evidence suggest strong associations between periodontal pathogens and such infections as pneumonia,\textsuperscript{68,69} and systemic diseases such as diabetes, and cardiovascular disease.\textsuperscript{70} In addition, poor oral health can affect the individual on a psychosocial plane such feelings of embarrassment regarding their oral health, often resulting in low self-esteem.\textsuperscript{3,5} Residents of LTC homes are often medically compromised due to chronic illness and/or advanced age, thus making them more prone to systemic infections. This state of reduced immunity, in combination with poor oral health status, puts this population at a high risk for developing infections and diseases with serious and sometimes lethal consequences.\textsuperscript{17,71}

2.5.1 Oral health-aspiration pneumonia association

It has been suggested that one of the main causes of institution-acquired (nosocomial) bacterial pneumonia is the aspiration of oropharyngeal fluids.\textsuperscript{72} More specifically, the colonization of the tongue, dentures, and other surfaces of the oral cavity by bacteria may serve as reservoirs of pathogens that have been associated with pneumonia.\textsuperscript{8,72-74} Residents of LTC homes who are most at risk for developing nosocomial pneumonia from aspiration of oropharyngeal fluids are those who have weakened host immune due to chronic illness (such as lung disease, congestive heart failure, or diabetes) and/or advanced age, those with depressed levels of consciousness due
to drugs such as sedatives or anticonvulsants which have the potential to substantially depress the central nervous system and/or respiratory response, and those on long term antibiotic therapy. A weakened or suppressed respiratory response results in an inability to expectorate aspirated fluids from the lungs and/or oropharyngeal pathways. Gram-negative bacteria, commonly associated with gingivitis and periodontitis, are frequently isolated from residents of LTC homes with institution-acquired pneumonia among residents of LTC homes. For an elderly LTC resident with a weakened immune system, and possibly presenting with underlying chronic diseases, aspiration pneumonia can significantly increase morbidity and mortality. Indeed, if microbiological surveys have implicated the oral cavity as the most likely origin of bacteria known to cause aspiration pneumonia, then improving oral health would seem to affect aspiration pneumonia incidence.

In an intervention study of residents of LTC homes, Yoneyama et al. tested whether improving residents’ oral hygiene would affect the frequency of pneumonia. In this randomized, single-blind clinical trial, residents’ teeth and dentures were cleaned by nurses or caregivers for 5 minutes after each meal. In addition, dentists and dental hygienists also provided any necessary professional debridement once per week to subjects in the experimental group. Pneumonia diagnosis criteria were chest radiographs, and clinical symptoms. The results showed that subjects in the experimental group (receiving oral care) had significantly lower febrile days and that confirmed cases of death due to pneumonia was half as much in experimental subjects as in control subjects. These results are similar to those of Ferozali et al. and Adachi et al.

In contrast, the results of an intervention study by Bassim et al. showed no significant difference in the measured health variables between control and experimental groups. In this study, wards within the same LTC home were divided into control and experimental groups, with
subjects in the experimental wards receiving oral hygiene care from a designated nursing aide (one aide per ward) whose primary function was to provide and monitor oral hygiene care. The results showed no significant difference in number of death from pneumonia between the groups. The investigators did recognize the many methodological limitations of this study, including non-randomization of subjects, confounding health variables of the residents within each ward, and lack of a well-defined oral hygiene protocol provided to the nursing aides who were to administer the intervention.

### 2.5.2 Periodontitis-diabetes association

The association between periodontal disease and diabetes (both Type 1 and 2) is supported by epidemiological surveys and immunological studies. \(^8^0\) Analysis of national surveys in the US such as National Health and Nutrition Examination Surveys (NHANES I, II, III) revealed that the association between periodontal disease and diabetes might be bidirectional. \(^8^1\) In other words, not only is periodontal disease more prevalent in diabetics than non-diabetics, but that diabetes is more prevalent in people with periodontitis compared to those with no periodontitis. The immunologic pathways by which one disease mediates the other are not fully understood. However, the prevailing theories involve 1) genetic host predisposition for both inflammatory diseases when the host is exposed to environmental stressors, and 2) upregulation of inflammatory enzyme mediators that are similar for both disease types, whereby an increase of these inflammatory enzymes as a result of one disease can adversely affect the clinical presentation of the other. \(^8^1\) Briefly, the inflammatory mediators associated with periodontitis such as tissue necrotic factor-α (TNF-α), Interleukin-6 (IL6), and IL1 are thought to adversely affect glucose and lipid metabolism in diabetics and contribute to the development and progression of diabetes complications. \(^8^2\) These inflammatory mediators have also been shown to
be insulin antagonists. Furthermore, speculative data suggest a bi-directional relationship between periodontal disease and diabetes.

In an extensive study involving participants of the National Health and Nutrition Examination Survey (NHANES III), Tsai et al. investigated the association between glycemic control in subjects with Type 2 diabetes and severe periodontal disease in an adult population. Their findings indicated that persons with Type 2 diabetes were almost Three times as likely to have severe periodontal disease compared to those without severe periodontal disease, even after controlling for age, education, smoking status, and extent of subgingival calculus.

Likewise, Saremi et al. in analyzing data from longitudinal studies of diabetes and associated complications in the Gila River Indian Community, AZ, USA, found that those with severe periodontitis had over three times the risk of cardio-renal mortality compared to those with moderate or less periodontal disease. The significantly greater heart disease and diabetic mortality risk associated with severe periodontitis persisted even after controlling for related cardio-renal mortality risk factors, such as smoking, age, hypertension, blood glucose, and cholesterol.

In another survey, Shultis et al. reported that subjects with moderate to severe periodontitis or edentulous were significantly associated with overt nephropathy and end-stage renal disease compared to those with mild periodontitis. The investigators used a proportional hazards model which adjusted for age, sex, diabetes duration, body mass index, and smoking. These findings are supported by those of Demmer et al.
2.5.3 Periodontitis and cardiovascular disease

There is considerable epidemiological and biological data linking periodontal disease to cardiovascular disease (CVD). Beck et al. proposed a hypothetical model to support the biological link between periodontal disease and CVD. They suggested that the pro-inflammatory response to bacterial infections such as periodontal disease is heightened in certain individuals, possibly due to genetic traits. As a result, inflammatory mediators such as PGE, IL-1β, and TNF-α are released in higher levels in these individuals than others. The increased level of these inflammatory mediators in the blood stream initiates platelet aggregation and adhesion, and promotes the deposition of cholesterol on the blood vessel walls.

2.6 Oral-Health Related Quality of Life (OHRoL)

There is general agreement among researchers that oral health problems can negatively impact oral-health related quality of life (OHRQoL). For example, having a reduced number of natural teeth can directly affect the ability to chew which is one of the main measures of OHRQoL. Other aspects of oral health, such as mouth pain or (dis)satisfaction with oral health, are also important factors to consider, but often are more subjective and difficult to quantify. Researchers have developed several instruments to measure oral health and related quality of life outcomes, such as the Geriatric Oral Health Assessment Index (GOHAI), the Oral Health Impact Profile (OHIP), including a 14-item version of OHIP (OHIP-14). The relationship between measures of oral health and psychosocial outcomes related to OHRQoL is often not perfectly linear and can be shaped by the adaptive capabilities of individuals, social environment and support, personal beliefs, and economics. Having said this, most studies have reported similar results showing that oral health is an important mediator of quality of life (QoL) and OHRQoL.
Locker et al. in an observational cohort study of independently living adults over the age of 50 assessed the relationship between measures of oral health and quality of life, including psychological well-being and life satisfaction. Measures of oral health were collected via self-ratings through personal interviews and clinical examinations, while general health and psychological well-being and quality of life information were provided through interviews. The results indicated significant associations between poor oral health-related self-ratings (such as dysfunction, pain, and disability) and low ratings of psychological well-being and life satisfaction, including lower morale, more life stress, and low levels of life satisfaction. The results of this study are supported by others.

In a 2004 study, Gilbert et al. studied the relationship between tooth loss incidence and chewing ability based on clinical examinations and personal interviews. Chewing ability was assessed by asking questions regarding the ability to chew or bite certain foods with well recognized hardness and texture. Responses were dichotomized into either ‘no’ chewing difficulty, or ‘yes’ chewing difficulty. The results showed that tooth loss was significantly associated with onset of chewing difficulty. Furthermore, participants with fewer occluding pairs of teeth were more likely to experience chewing difficulty than those with more pairs of occluding teeth. These findings indicate that tooth loss incidence has a significant effect on the ability to chew, an important measure of OHRQoL. The results of this study are similar to others.

In a qualitative investigation of an elderly population, MacEntee et al. interviewed a group of independent elders to explore their experiences, feelings, and concerns regarding the significance of the mouth in their lives. A common theme in the responses described chewing difficulties caused by loose or uncomfortable dentures. Other oral-related concerns involved pain from toothaches or ill-fitting dentures, decrease in the enjoyment of food, and social discomfort. The
responses also revealed a great degree of adaptability among the participants with regards to the state of their oral health, accepting it as part of the aging process.

### 2.7 Barriers to good oral health within the LTC setting

There is an increasing body of evidence documenting the barriers to oral health care affecting residents of LTC homes.\(^{21,23,29,30,99,100}\) In the LTC setting, personal support workers (PSWs) provide the majority of assistance with residents' ADLs, including daily oral hygiene.\(^{22,100,101}\)

One of the most common barriers to oral care provision cited by PSWs is lack of knowledge regarding oral health and mouth care provision.\(^{23,24,30,102}\) Indeed, misconceptions about oral health and mouth care are common among PSWs of LTC homes.\(^{102}\) Additionally, other barriers include lack of time, low staffing levels, resident co-operation, and fear of mouth care provision.\(^{99,101}\) Researchers have suggested that care providers’ beliefs and attitudes towards oral health can significantly influence their oral hygiene provision behaviour.\(^{100,101}\) Unfortunately, studies have shown that, when confronted with time constraints, oral care provision is often given low priority by PSWs.\(^{100,101}\)

In a study of factors contributing to the mouth care practices in LTC homes, Vanobbergen\(^{103}\) used a questionnaire to identify the type and level of mouth care services provided to residents of LTC homes. The results showed that care givers’ level of knowledge was the most significant predictor of level of mouth care provision. In addition, when mouth care assistance was provided, it was done so without reference to individual residents’ needs. This was explained by the finding that structured oral health assessment and reporting was rarely used in the participating homes.

Coleman et al.\(^{99}\) utilized a combination of direct observation, retrospective chart review, and interviews to assess the quality and quantity of care provided to residents by PSWs. Oral care
provision was also observed, including the type and duration of care. Only those residents who needed assistance or supervision with oral care were included in the study. The results showed that even though all of the residents selected for the study required assistance with oral care, only 16% actually received it. On average, PSWs spent only 16 seconds brushing residents’ teeth, much shorter than the recommended time for this procedure (1 – 2 minutes). Additionally, most residents did not have the appropriate oral care supplies, and PSWs were observed to make little or no attempt to identify or obtain these supplies, suggesting that oral care provision was not part of the normal daily routine. PSWs revealed in interviews that barriers such as lack of time, low staffing, resident behaviours, and fear of oral care duties affected their oral care provision. Just over 25% of the PSWs had attended an oral care in-service during the previous year.

2.8 Previous intervention studies

Mouth care interventions have been developed and implemented to address the poor oral health among residents of LTC homes. However, there is limited evidence in the literature to support their effectiveness. Almost all of the interventions utilize the traditional method of an in-service. An “in-service” is an educational workshop incorporating a combination of media to maximize content accessibility. The most frequently used medium is the video (or CD-ROM) to ensure content consistency over numerous in-services. However, hands-on demonstrations and question/answer (Q/A) sessions may also be incorporated into the overall in-service for content clarification. The methodology of these intervention studies also involves assessing care providers’ knowledge regarding mouth care before and after the intervention and has been shown to be effective in the transference of information as measured by participants’ knowledge.
In a recent study, Reed et al. developed an in-service workshop that included PowerPoint presentations and hands-on demonstrations of daily mouth care provision for LTC residents, including oral health promotion, oral disease prevention, and proper oral hygiene techniques. Care providers’ mouth care knowledge was assessed using an oral health knowledge questionnaire before and after the in-service intervention. The results indicate that the in-service was effective in significantly improving mouth care knowledge. However, residents’ oral health outcomes were not assessed in this study.

There have been few mouth care intervention studies which have assessed both care providers’ knowledge and residents’ health outcomes and analyzed the relationship between these variables. Indeed, the results of these studies have been conflicting, since the difficulty lies in measuring care providers’ mouth care provision behavior longitudinally in an industry known for high employee turn-over rates, lack of administrative support, and lack of time.

In a 2000 intervention study, Simons et al. evaluated the effect of an oral health training program on care providers’ knowledge and residents’ oral health longitudinally. The investigators used a 90 minute in-service training program as their intervention, which included a video, hands-on demonstration, and discussions. Care providers’ mouth care knowledge was assessed at baseline and 1 week after the intervention. Residents’ oral health outcomes were measured by the Plaque Index and Gingival Index, at baseline and one-year follow-up. Interviews with residents were conducted post intervention to subjectively evaluate any changes in mouth care provision behavior from their care providers. This study had a control group where care providers did not receive the training program. The results showed a significant gain in mouth care knowledge among care providers. However, interviews with the residents revealed that there were no significant changes in their care providers’ mouth care provision
behavior. In addition, residents’ oral health outcomes after one year did not differ significantly either from baseline or between control and experimental groups. A significant limitation encountered by the investigators was a lack of support from the LTC home managers, since the investigators had originally planned three in-service sessions, but the home managers refused to allow their staff to attend all three sessions. Thus only one in-service session was used in this study.

Similarly, Bassim et al.\textsuperscript{79} also wanted to evaluate the effect of care providers’ mouth care behavior on residents’ health outcomes. In this controlled study, the investigators assigned a PSW to each of the experimental wards within a LTC home. Each PSW’s dedicated function was to prepare, assist, or provide mouth care to the residents of their assigned ward. The assignment of a PSW whose dedicated function was mouth care provision would control for factors such as lack of time or knowledge which are often cited as significant barriers to mouth care provision in the LTC setting. The control groups (wards) did not receive a specially assigned mouth care PSW. The investigators measured pneumonia mortality risk as their health outcome. The results showed no significant differences in number of deaths from pneumonia between control and experimental groups. One limitation of this study was that the mouth care provision protocol for the PSWs in the experimental groups was not well defined which might have affected the quantity and quality of mouth care provided to the residents, and residents were not stratified into different levels of care, which may have affected the level of assistance provided by the PSW. As stated earlier, this was not well defined in the mouth care protocol of the study.
2.9 Conclusion

The oral health of residents of LTC homes have been described in the literature as poor. Due to a combination of decreased physical/mental capabilities, residents of LTC homes are unable to maintain their own daily mouth care and frequently must rely on support staff for assistance. However, studies have shown there are barriers experienced by support staff that can hinder their assistance with residents’ daily mouth care activities. One of the most commonly cited barriers to providing mouth care assistance is lack of knowledge and training regarding mouth care. The current literature regarding mouth care educational intervention to improve the oral health of residents of LTC homes yields conflicting results, with a myriad of oral health measures used, length of study, and methodologies. No consensus exists regarding the effectiveness of educational interventions to improve the oral health of residents of LTC homes since current studies vary greatly in their methodology, assessment of oral health outcomes, and study lengths.
Chapter 3
Materials and Methods

3 Study Design

In this controlled single blind quantitative study, participating LTC homes were randomly assigned to either control or experimental groups. Personal support workers in the experimental group had their mouth care knowledge assessed at baseline (pre-test) just prior to mouth care education, and then after the education (post-test). PSWs’ mouth care knowledge was reassessed at the 6-months follow-up. Personal support workers in the control group had their mouth care knowledge assessed at the conclusion of the study, prior to receiving their mouth care education. In both groups, mouth care post-test knowledge was assessed immediately following the mouth care education.

All participating residents had their oral health assessed at baseline prior to PSWs’ oral health education, and at 6-months follow-up. A summary of the study’s design can be seen in Figure 1. This study was approved by the Research Ethics Board, University of Toronto; reference #24033.

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<th>Baseline</th>
<th>6-Months</th>
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<tr>
<td><strong>Control Group</strong></td>
<td>PSWs: No data gathered</td>
<td>PSWs: Knowledge pre-test</td>
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<td>Mouth Care Education</td>
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<td></td>
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<td>Knowledge post-test</td>
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<tr>
<td>Residents:</td>
<td>PI &amp; GI</td>
<td>Residents: PI &amp; GI</td>
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<tr>
<td><strong>Experimental Group</strong></td>
<td>PSWs: Knowledge pre-test</td>
<td>PSWs: Follow-up knowledge test</td>
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<td>Mouth Care Education</td>
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<td>Residents:</td>
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Figure 1. Study Design
3.1 Long term care homes

Twenty LTC homes in the Greater Toronto Area (GTA) were approached either by telephone or in person with an introduction to the study and its purpose and methodology. Those LTC homes that consented to participate were then given a more detailed outline of the proposed study, including an introduction, methodology, and benefits and risks of the study. (Appendix 1) Only publicly funded homes were approached regarding participation in this study. This study underwent each LTC home’s internal ethics review board.

Once consent to participate in the study was received by the LTC homes (Appendix 2), the principal investigator collaborated with each home’s educational administrator regarding an implementation plan. Introduction letters were distributed to all PSWs and potential resident participants. Although all residents were welcomed to participate, potential resident-participants in each facility were identified in advance by each facility’s internal staff in accordance with the resident-participant selection criteria (see section 3.5 – Residents).

3.2 Personal support worker (PSWs)

In long term care homes PSWs provide direct personal care to the residents. This care includes functions of Activities of Daily Living, including dressing, toileting, feeding, transferring, and can also include daily mouth care such as oral soft tissue inspection, tooth brushing, and denture care. In order to work as a personal support worker in long term care homes, a person can obtain formal training at a community college PSW program which can last up to 6 months. However, formal training is often not a requirement for employment as a PSW in long term care homes and the profession remains unregulated by the Ontario Provincial Government.108 Thus, entry-to-
practice training and knowledge can vary greatly among PSWs. In this study, the target population to receive the mouth care education was all PSWs employed at each LTC home. Since the PSWs in these LTC homes often worked in different shifts it was difficult to identify which PSWs provided care for which residents. In addition, the PSWs often changed their shift schedule according to their personal needs or the needs of the LTC home. This made it difficult to assign PSWs to certain shifts (such as the evening shift) when mouth care was most likely to be performed. However, the minimum expectation was that residents should have their teeth and/or dentures cleaned at least once a day (i.e. before bedtime). It was concluded by both the principal investigator and each LTC home’s director that all PSWs could benefit from the mouth care education. For these reasons, all PSWs were invited to participate and attend the mouth care in-services.

Introduction letters explaining the study’s methodology, possible risks and benefits, and participants’ rights were distributed to all PSWs. (Appendix 3) The only participant selection criterion for PSWs in this study was that they were able to read and understand English, since the mouth care educational program and knowledge test were only available in English. There were no other PSW inclusion/exclusion criteria. All facility staff was invited to attend the mouth care educational sessions. However, only those PSWs who consented to participate (Appendix 4) in the study were requested to take the mouth care knowledge tests.

### 3.3 PSW demographics and mouth care knowledge

In this study, the following demographic information was collected from PSWs: age, gender, years of LTC experience, number of residents cared for during each work shift, and barriers encountered when providing daily mouth care. PSWs were requested to include their name or initials for data tracking and linkage purposes, since each participating PSW might complete
more than one knowledge test (such as baseline, post-test, and 6 months). However, at the conclusion of the study all names or initials were removed and participants’ knowledge tests were labeled with code identifiers to ensure their anonymity.

PSWs’ mouth care knowledge was measured using a 20-item knowledge test. This knowledge test was developed from a review of the relevant literature and then tailored to meet the educational objectives of the mouth care program (see section 3.4 – Mouth care education). The final version of the knowledge test was arrived at after consultation with researchers in the field of LTC oral health, including two dentists, two dental hygienists, and two dental educators. The knowledge test was then pre-tested on a group of non-dental individuals and then revised for content clarity. The same knowledge test was used as baseline pre-test, post-test, and 6 month follow-up test. (Appendix 9) The development of the knowledge test was geared specifically for the learning objectives (section 3.4) of this study’s mouth care education and was not meant to be a global assessment of knowledge regarding oral health and mouth care provision. The knowledge test items covered the three main subject areas of mouth care in long term care, including A) oral health promotion and disease prevention, B) daily mouth care provision for persons in LTC, and C) special mouth care such as mouth care for resistive/combative residents, mouth care for unconscious residents, and denture care. The knowledge test contained 14 dichotomized true/false questions and six multiple choice questions.

Participating PSWs in experimental LTC homes took the knowledge pre-test at baseline prior to receiving the mouth care education. The same knowledge test was administered immediately after the educational sessions to measure the change in knowledge as a result of the mouth care education program. The advantage of administering the post-test immediately after the education was that the response rate would be higher than conducting the post-test at a later time.
since the PSWs were already present in the room. The disadvantage is that there would be an expected higher test score due to a carry-over effect. However, this carry-over effect was minimized with a 6-months follow-up knowledge test administered at the conclusion of the study. The PSWs in control homes took the same knowledge pre-test and post-test, all administered at the conclusion of the study. The pre- and post-tests were conducted under the supervision of the principal investigator, while the 6-month follow-up tests were not supervised. Instead, the 6-month tests were given to the head nurse of each participating LTC home in the experimental group to be distributed to the PSWs to complete on their own time. Personal support workers in control homes were not given a 6-months follow-up knowledge test.

3.4 Mouth care education

The mouth care education package, Mouth Care for Persons in Residential Care, was developed by the ELDERS group (Elders’ Link with Dental Education, Research and Services), University of British Columbia. This education package includes a handbook written material, a CD-ROM video, and a PowerPoint presentation. The mouth care education covered the subject areas of oral health promotion and disease prevention, daily mouth care techniques including denture care, overcoming barriers to providing daily mouth care, and mouth care decision making strategies in the LTC setting. In this study the mouth care education was delivered as an in-service, which is the most common method of knowledge dissemination within the LTC environment. In this study the CD-ROM video was chosen as the delivery medium for its content consistency. Each facility received a minimum of one mouth care in-service, although efforts were made to schedule more than one in-service in each facility to accommodate the various work shifts of the PSWs, and also depending on the size of the facility. A 60-minute mouth care in-service duration was chosen to minimize intrusion into the busy work schedules of
the staff: ten minutes were reserved for the knowledge pre-test, 40 minutes were reserved for the mouth care video, and ten minutes at the end were used to complete the knowledge post-test. It was hoped that this small time frame would increase participating among the PSW staff. At the conclusion of the study, all participating LTC homes were given a mouth care handbook to supplement the mouth care in-services. This handbook contained the same material covered in the in-service.

3.5 Residents

In this study only residents with teeth and who were able to understand and give informed consent were invited to participate. These potential resident-participants were pre-identified with the assistance of the attending staff at each LTC home. The teeth-only selection criterion was chosen because this study used the Plaque Index and the Gingival Index as measurements of residents’ oral health outcomes. Informed consent from resident-participants was considered important in order to minimize the combative/resistive behaviors associated with persons with severe mental diseases such as Alzheimer’s or Dementia which can hinder a PSW’s ability to perform daily mouth care. In some cases where the resident was able to understand the purpose and methods of the study and wanted to participate but was unable to sign the consent form due to a physical disability, such as severe arthritis, then an alternate decision maker was asked to sign the consent form. (Appendix 6) Introduction letters and invitation to participate in the study were distributed to all residents. (Appendix 5) There were no other participation exclusion criteria. Residents’ demographic data included age, gender, and number of teeth present.

Residents who participated in the study were not matched or paired up with any PSW who participated in the study in each LTC home. The nature of PSW employment in these participating long term care homes meant that the PSWs might be transferred to another unit of
the same home where their skills are needed. To match residents with PSWs for the duration of the study required a level of cooperation which was not feasible for the LTC home managers.

3.6 Residents’ oral health outcomes

Residents’ oral health was measured by the Plaque Index (PI)\textsuperscript{110} and Gingival Index (GI)\textsuperscript{111} which were modified for use in this study (explained in the next sections). These indices have been used extensively in the oral health literature and have been proven to be both reliable and valid measures of participants’ oral hygiene outcome. In addition, the choice of using established measures of oral health can contribute to the existing literature for the purpose of data comparisons. Clinical measurements were done using a World Health Organization (WHO) examination kit of intraoral mouth mirror, a WHO explorer, and a WHO periodontal probe. A portable headlight was used to illuminate the oral cavity for inspection. Residents’ teeth were not disclosed prior to the measurement of both the PI and GI due to some residents’ inability to rinse properly, or higher risk of aspiration.

3.6.1 Plaque Index

This index was first proposed in 1964 by John Silness and Harald Loe\textsuperscript{110} as a way to measure the state of oral hygiene in subjects by assessing the amount of soft deposits (dental plaque) on certain teeth surfaces. In the original index by Silness and Loe, the location of these teeth is prescribed and missing teeth are not substituted. In this study, however, the target LTC resident population often has a large range of missing teeth. For this reason, the Plaque Index was modified for use in this study, whereby missing teeth were substituted, often with the nearest tooth present. (Appendix 7)
3.6.2 Gingival Index

The Gingival Index (GI) was first proposed in 1963 by Harald Loe and John Silness\textsuperscript{111} as a way to score the different grades of gingival (gum) inflammation. The GI assigns numerical scores to describe the level of inflammation around a prescribed set of teeth within the mouth. These teeth are the same teeth used in the Plaque Index. The Gingival Index and Plaque Index are often used together to assess the level of oral hygiene of an individual, since the level of plaque on the teeth and adjacent to the gingival margin often results in inflammation of the gums adjacent to those teeth. As with the PI, the Gingival Index was modified for use in this study, whereby missing teeth were substituted with the nearest tooth present. (Appendix 8)

3.7 Participants’ rights and anonymity

Participation in this study was voluntary and only by informed consent. Participants could refuse or withdraw participation at any time during the course of the study without negative consequence to their employment or residential status within their present or any future LTC facility. All residents and PSWs had equal opportunities to participate in this study within the participant selection criteria. Participating residents received complimentary oral hygiene assessments conducted by a dental professional as a benefit of participating in this study. The results of these oral hygiene assessments, including the resident’s current oral hygiene status, oral hygiene treatment needs, or dental treatment needs were communicated to each resident or family member individually. In addition, oral hygiene aide such as toothbrushes, toothpaste, denture brushes or any other oral hygiene aides specific to each resident’s individual oral hygiene needs were provided free of charge. No participants received any monetary reward or compensation in return for participation in this study. Participants’ data documents, such as oral hygiene assessments and knowledge tests, were de-identified using code identifiers. Throughout
the study, however, participants’ data documents were identified by their names for the purpose of data linkage between baseline and follow-up. Participants’ hard-copy data documents were stored in a locked metal cabinet in the office of the principal investigator. Only the principal investigator had access to these original data documents for the purpose of statistical analysis. Participants’ electronic data were encrypted and stored in a password-protected electronic source. Participants’ data, whether hardcopy or electronic, never left the office of the principal investigator. The results of this study were reported as group data only, and no individual LTC home, resident, or PSW were identified by name.

3.8 Sample size calculation

A sample size calculation based on a previous study by Frenkel et al.\textsuperscript{112} which was similar to this study with regards to study design and measures of oral health outcomes. In the Frenkel study, their intervention group plaque scores had a $SD=0.49$ and an adjusted difference between control and intervention groups of $D=0.34$. In the present study, a difference between control and experimental groups of $D=0.40$, with 80% power was used. A 40% dropout rate was assumed. Alpha represents the probability of a Type I error, $\alpha=.05$. Beta represents the probability of a Type II error, $\beta=.20$. Sigma represents the standard deviation, $\sigma=0.49$. $D$ represents the clinically relevant difference in clinical measures between control and experimental groups. The following equation was used to determine the minimum sample size of $n=33$ participants in this study in each group:

$$n = \left( \frac{\sigma_1^2 + \sigma_2^2}{D^2} \right) \times \left( z_{1-\alpha/2} + z_{1-\beta} \right)^2$$

Thus,
Equation 1: Sample Size Calculation

\[ n = ((.49)^2 + (.49)^2) X (z_{.975} + z_{.80})^2 = .48 x (1.96 + .84)^2 / .16 x 1.4 \text{ (dropout)} = 33 \text{ subjects.} \]

\[ (.4)^2 \]

3.9 Intra-rater reliability

Oral digital photographs were taken of residents’ teeth at baseline and follow-up. These oral pictures were meant to be used as an oral health outcomes inter-rater reliability tool with external clinicians. These pictures only show the participant’s retracted lips, teeth, and gingiva, thus ensuring anonymity of subjects. These types of oral pictures are commonly used in dental research as a photo-record of clinical findings, and also as a valid method of recording visual changes over time.\textsuperscript{113,114} The oral photographs in this study were all taken by the principal investigator using the same camera at the same camera setting. Efforts were made to maintain the same camera angle across all photographs, although sometimes this was not possible in the LTC setting. Anterior views were taken with the subjects’ teeth occluded, and the lips were retracted using disposable cheek retractors, adult size, by DiaDent Group International.\textsuperscript{115} Two photographs were taken of each resident’s teeth at each clinical assessment time point for a total of 4 photographs for every resident. For reliability calibration purposes, only one photograph was used.

An intra-rater reliability test was done using the intra-oral photographs taken of the participating residents’ teeth. Eight teeth were randomly chosen from the collection of photographs. The images of these teeth were then isolated from within each photograph and de-identified for calibration using the modified PI and modified GI. Due to the visual limitations of these
photographs, only anterior teeth and facial surfaces were chosen for this exercise, with three surfaces used per tooth. The total number of surfaces used for the reliability test was 24. The principal investigator then scored the plaque levels using the modified PI and gingival inflammation using the modified GI. The principal investigator was blinded to the identity and group assignment of each tooth. The modified PI and GI scores were then correlated with the original modified PI and GI clinical scores of the same teeth that were used on the residents using the Intraclass Correlation Coefficient (ICC). The results of the ICC were similar to a preliminary correlation using Pearson’s R. Table 1 illustrates the results of the intra-rater reliability test using the Intraclass Correlation Coefficient.

Table 1. Plaque Index and Gingival Index Intra-rater Reliability

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<th>Gingival Index</th>
<th>Plaque Index</th>
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<tr>
<td>ICC</td>
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<td>.95</td>
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</table>

3.10 Inter-rater reliability

A selection of six oral photographs from both the experimental and the control groups, representing a variation of levels of oral hygiene was used with two external clinicians to assess inter-rater reliability, with a total of 16 teeth (48 surfaces). These external clinicians were blinded to the residents’ study group designation (control vs. experimental) or time of clinical assessment (baseline vs. follow-up). An example of an oral photograph used for the rater calibrations can be seen in Appendix 10. Table 2 illustrates the modified PI and GI inter-rater reliability, with the $ICC > .80$ for all raters.
Table 2. PI and GI Inter-rater Reliability.

<table>
<thead>
<tr>
<th></th>
<th>Principal Investigator &amp; Rater 1</th>
<th>Principal Investigator &amp; Rater 2</th>
<th>Rater 1 &amp; Rater 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PI ICC</strong></td>
<td>.92</td>
<td>.98</td>
<td>.88</td>
</tr>
<tr>
<td><strong>GI ICC</strong></td>
<td>.89</td>
<td>.97</td>
<td>.89</td>
</tr>
</tbody>
</table>

3.11 Statistical analysis

The Statistical Package for the Social Sciences (SPSS) version 17.0 was used to analyze the data in this study. Statistical analysis in this study included descriptive statistics to describe the distributions of participants’ demographics, Pearson’s correlations to describe the relationships between certain variables. For comparison of means within and between groups, parametric analysis was done, including t-tests, ANOVAs, and ANCOVAs. Significance was set at p=.05.

A non-parametric Friedman’s ANOVA was conducted to evaluate the difference in proportions of correct responses of individual test items between knowledge tests, followed by a McNemar test of significance for pair-wise comparisons, with a Bonferroni adjustment of the significance level set at p=.01 for these tests.
Chapter 4
Results

4 Results

4.1 Long term care homes

Twenty LTC homes in the greater Toronto area (GTA) were approached either by phone or in person regarding participating in this study. Five (25%) LTC homes consented to participate. These 5 homes were then randomly assigned to either control or experimental groups. All participating homes were considered “publicly funded” homes. The results of the LTC home random assignment and home sizes (number of beds) are illustrated in Table 3. The homes are not listed in any specific order.

Table 3. LTC Home Group Designation and Number of Beds

<table>
<thead>
<tr>
<th>LTC Home Group Designation</th>
<th>Control Group</th>
<th>Experimental Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home A (small)</td>
<td>60 Beds</td>
<td></td>
</tr>
<tr>
<td>Home B (medium)</td>
<td>150 Beds</td>
<td></td>
</tr>
<tr>
<td>Home C (large)</td>
<td>218 Beds</td>
<td></td>
</tr>
<tr>
<td>Home D (large)</td>
<td></td>
<td>226 Beds</td>
</tr>
<tr>
<td>Home E (large)</td>
<td></td>
<td>350 Beds</td>
</tr>
<tr>
<td>Total Number of Beds</td>
<td>428 Beds</td>
<td>576 Beds</td>
</tr>
</tbody>
</table>
4.2 Personal support workers

4.2.1 Demographics

There were 29 PSW participants in the control group and 47 PSW participants in the experimental group. The majority of PSWs in both groups were female. Table 4 shows the PSWs’ gender distribution for each group.

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Experimental</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>5 (17.24%)</td>
<td>24 (82.76%)</td>
</tr>
</tbody>
</table>

Eighty-two percent of the PSWs in the control group were over the age of 40 compared to 78% of the PSWs in the experimental group. Table 5 shows the complete PSW age proportions within each group.

Personal support workers in the control group cared for an average of 10.97 (SD=5.04) residents, while PSWs in the experimental group cared for an average of 16.28 (SD=8.25) residents. An independent-samples t-test was conducted to compare the mean number of residents cared for by PSWs between control and experimental groups. The test was significant, \( t(74) = 3.49, p<.05 \). On average, PSWs in the experimental group cared for a significantly higher number of residents than those in the control group.
Table 5. Personal Support Workers Age Categories

<table>
<thead>
<tr>
<th>Personal Support Workers Age</th>
<th>&lt; 20 yrs</th>
<th>20 – 29 yrs</th>
<th>30 – 39 yrs</th>
<th>40 – 49 yrs</th>
<th>&gt; 50 yrs</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td>4 (13.79%)</td>
<td>1 (3.45%)</td>
<td>8 (27.59%)</td>
<td>16 (55.17%)</td>
<td>29 (100%)</td>
</tr>
<tr>
<td>Experimental</td>
<td>2 (4.26%)</td>
<td>1 (2.13%)</td>
<td>7 (14.89%)</td>
<td>22 (46.81%)</td>
<td>15 (31.91%)</td>
<td>47 (100%)</td>
</tr>
</tbody>
</table>

With regards to levels of experience working in LTC homes, 16 PSWs (55.18%) in the control group had less than ten years, while 10 PSWs (34.48%) had between ten and nineteen years, and three PSWs (10.34%) had 20 or more years of experience. Thirty PSWs (63.83%) in the experimental group had less than ten years of experience working in LTC settings, 15 PSWs (31.91%) had between ten and nineteen years of experience, while two PSWs (4.26%) had 20 or more years.

4.2.2 Mouth care barriers

“Uncooperative residents” was the most commonly identified barrier to daily mouth care by PSWs in both groups, followed by “resident’s bad breath,” and “not enough time”. Figure 2 summarizes the distribution of daily mouth care barriers encountered by the PSWs between control and experimental groups.
4.2.3 Mouth care knowledge

Personal support workers in the control group took the mouth care knowledge pre-test and post-test at the conclusion of the study, with no 6-months follow-up tests, while PSWs in the experimental group took the knowledge pre-test and post-test at the beginning of the study and the follow-up tests at 6 months. Twenty-nine PSWs in the control were able to complete both knowledge pre-tests and post-tests. Forty-seven PSWs in the experimental group were able to complete the knowledge pre-tests and pre-tests, but only 32 of them completed all three knowledge tests: pre-test, post-test, and 6-months follow-up. Thus, only those 32 PSWs in the experimental group who were able to complete all three tests were included in the final
knowledge tests analyses. Table 6 shows the results of the knowledge tests for both groups. The knowledge test statistics are for a 20-item knowledge test.

Table 6. Personal Support Workers' Knowledge Tests Results

<table>
<thead>
<tr>
<th></th>
<th>Control (n=29)</th>
<th>Experimental (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test</td>
<td>Post-test</td>
</tr>
<tr>
<td>Mean</td>
<td>15.31 (77%)</td>
<td>18.00 (90%)</td>
</tr>
<tr>
<td>SD</td>
<td>2.12</td>
<td>2.02</td>
</tr>
<tr>
<td>Min</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Max</td>
<td>19</td>
<td>20</td>
</tr>
</tbody>
</table>

4.2.3.1 Control group

A Factorial ANOVA was conducted to evaluate the effects of age, LTC experience, and time on the control PSWs’ knowledge test means. The ANOVA indicated no significant interaction between PSWs’ age categories and time, $F(3, 42)=.21, p=.89, \eta^2=.02$, no significant interaction between PSWs’ LTC experience and time, $F(2, 42)=.09, p=.92, \eta^2=.00$, no significant interaction between PSWs’ age and LTC experience, $F(2, 42)=1.74, p=.19, \eta^2=.08$, and no significant interaction between time, age, and LTC experience, $F(2, 42)=1.40, p=.26, \eta^2=.06$. The main effect of age on knowledge test means was not significant, $F(3, 42)=.91, p=.45, \eta^2=.06$. The main effect of LTC experience on knowledge test means was also not significant, $F(2, 42)=.60, p=.56, \eta^2=.03$. The main effect of time was significant, $F(1, 42)=11.78, p<.05, \eta^2=.22$. Since there were only two time points of interest in the control group (pre-test and post-test), it can be seen from Table 6 that PSWs’ post-test mean was
significantly higher than their pre-test mean. Table 7 summarizes the results of the control group’s age, LTC experience, and time factorial ANOVA.

Table 7. Control group: age, time, LTC experience ANOVA

<table>
<thead>
<tr>
<th>Dependent Variable: Test Mean</th>
<th>F</th>
<th>df</th>
<th>p value</th>
<th>η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>11.78</td>
<td>1</td>
<td>0.00ᵃ</td>
<td>0.22</td>
</tr>
<tr>
<td>Age</td>
<td>0.91</td>
<td>3</td>
<td>0.45</td>
<td>0.06</td>
</tr>
<tr>
<td>LTC experience</td>
<td>0.60</td>
<td>2</td>
<td>0.56</td>
<td>0.03</td>
</tr>
<tr>
<td>Time * Age</td>
<td>0.21</td>
<td>3</td>
<td>0.89</td>
<td>0.02</td>
</tr>
<tr>
<td>Time * LTC experience</td>
<td>0.09</td>
<td>2</td>
<td>0.92</td>
<td>0.00</td>
</tr>
<tr>
<td>Age * LTC experience</td>
<td>1.74</td>
<td>2</td>
<td>0.19</td>
<td>0.08</td>
</tr>
<tr>
<td>Time * Age * LTC experience</td>
<td>1.40</td>
<td>2</td>
<td>0.26</td>
<td>0.06</td>
</tr>
</tbody>
</table>

ᵃ significant at p < .05.

4.2.3.2 Experimental group

A Factorial ANOVA was conducted to evaluate the effects of age, LTC experience, and time on knowledge test means of the 32 PSWs in the experimental group who completed all three knowledge tests. The ANOVA indicated no interaction between PSWs’ age and time, $F(6, 72)=1.65, p=.15$, partial $\eta^2=.12$, no significant interaction between PSWs’ LTC experience and time, $F(4, 72)=2.2, p=.07, \eta^2=.11$, no interaction between PSWs’ age and their LTC experience, $F(2, 72)=.65, p=.53, \eta^2=.02$, and no interaction between PSWs’ age, LTC experience, and time, $F(4, 72)=1.56, p=.20, \eta^2=.08$. The main effect of PSWs’ age was significant $F(3, 72)=2.9, p<.05, \eta^2=.11$. A follow-up analysis of the main effect of PSWs’ age showed that those PSWs aged 50 years and older did significantly better on their knowledge tests than
those PSWs less than 29 years of age. All other age groups comparisons were non-significant. The main effect of time was also significant, $F(2, 72)=4.90, p<.05$, partial $\eta^2=.12$. A follow-up analysis of the main effect of time using the Least Significant Difference (LSD) method showed that PSWs’ post-test mean and 6-months test mean were both significantly higher than their pre-test mean. However, there was no significant difference between their post-test and 6-months test means. The main effect of PSWs’ LTC experience was not significant, $F(2, 72)=1.12, p=.33$, partial $\eta^2=.03$. Table 8 summarizes the results of the experimental group’s age, time, and LTC experience factorial ANOVA.

Table 8. Experimental group: age, time, LTC experience ANOVA

<table>
<thead>
<tr>
<th>Dependent Variable: Test mean</th>
<th>$F$</th>
<th>df</th>
<th>$p$ value</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>4.90</td>
<td>2</td>
<td>0.01$^a$</td>
<td>0.12</td>
</tr>
<tr>
<td>Age</td>
<td>2.90</td>
<td>3</td>
<td>0.04$^a$</td>
<td>0.11</td>
</tr>
<tr>
<td>LTC experience</td>
<td>1.12</td>
<td>2</td>
<td>0.33</td>
<td>0.03</td>
</tr>
<tr>
<td>Time * Age</td>
<td>1.65</td>
<td>6</td>
<td>0.15</td>
<td>0.12</td>
</tr>
<tr>
<td>Time * LTC experience</td>
<td>2.23</td>
<td>4</td>
<td>0.07</td>
<td>0.11</td>
</tr>
<tr>
<td>Age * LTC experience</td>
<td>0.65</td>
<td>2</td>
<td>0.53</td>
<td>0.02</td>
</tr>
<tr>
<td>Time * Age * LTC experience</td>
<td>1.56</td>
<td>4</td>
<td>0.20</td>
<td>0.08</td>
</tr>
</tbody>
</table>

$^a$ significant at $p<.05$

4.2.3.3 Control vs. experimental test means

A Factorial ANOVA was conducted to assess the effect of time (pre-test vs. post-test) on PSWs’ mouth care knowledge between control and experimental groups. The ANOVA indicated no significant interaction between time and groups, $F(1, 118)=.41, p=.52$, $\eta^2=.00$. There was no
significant differences in pre-test and post-test means between control and experimental groups, $F(1, 118)=.21, \ p=.65, \ \eta^2=.00$. There was a significant difference in knowledge test means between pre-test and post-test for both control and experimental groups, $F(1, 118)=52.00, \ p<.05, \ \eta^2=0.31$. The results in Table 6 indicate that PSWs in both groups significantly increased their post-test mouth care knowledge compared to their pre-test knowledge.

The results of the experimental PSWs’ performance on the individual test items for pre-test, post-test and 6-months can be seen in Table 9. A Friedman’s ANOVA was conducted to evaluate the relationship between proportions of correct responses to each question of the knowledge tests. A Bonferroni adjustment was made to the significance level (p=.05), with the adjusted significance level for this analysis set at p=.01. A McNemar Test of Significance was used to conduct pair-wise comparisons of the proportions of correct responses for those test items with a significant difference between tests. Again, the adjusted significance level was set at p=.01.

Table 9. Knowledge test items and pre/post/6-months Friedman’s ANOVA, with McNemar pair-wise comparisons.

<table>
<thead>
<tr>
<th>Mouth Care Knowledge Test</th>
<th>Pre-test (% correct)</th>
<th>Post-test (% correct)</th>
<th>6 month (% correct)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. It is natural to lose your teeth as you get older. (T/F)</td>
<td>44</td>
<td>81*</td>
<td>66</td>
</tr>
<tr>
<td>2. It is natural for health gums to bleed when brushed with a toothbrush. (T/F)</td>
<td>75</td>
<td>87</td>
<td>84</td>
</tr>
<tr>
<td>3. Gum disease can be prevented by daily removal of plaque and food debris from the teeth, gums, and dentures. (T/F)</td>
<td>97</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>4. Providing mouth care is not important, especially when time is limited. (T/F)</td>
<td>97</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>5. The best way to treat dry mouth is (provide frequent sips of water to moisten the mouth).</td>
<td>81</td>
<td>94</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>6. Dentures should be cleaned and brushed over a counter top. (T/F)</td>
<td><strong>56</strong></td>
<td><strong>69</strong></td>
<td><strong>44</strong></td>
</tr>
<tr>
<td>7. The best time to clean a resident’s mouth is at night before bedtime. (T/F)</td>
<td><strong>53</strong></td>
<td><strong>72</strong></td>
<td><strong>56</strong></td>
</tr>
<tr>
<td>8. Persons with full dentures do not need daily mouth cleaning. (T/F)</td>
<td><strong>97</strong></td>
<td><strong>97</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>9. Dentures should be cleaned by (brushing the denture using liquid soap and water).</td>
<td><strong>16</strong></td>
<td><strong>91</strong></td>
<td><strong>56</strong></td>
</tr>
<tr>
<td>10. Tooth loss is NOT a natural part of aging. (T/F)</td>
<td><strong>53</strong></td>
<td><strong>69</strong></td>
<td><strong>69</strong></td>
</tr>
<tr>
<td>11. To prevent bad breath, gum disease, and tooth decay, plaque and debris should be removed from the mouth and dentures (every day).</td>
<td><strong>91</strong></td>
<td><strong>94</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>12. Healthy residents living in the same room can share toothbrushes. (Never)</td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>13. The health of the mouth is related to the health of the body. (T/F)</td>
<td><strong>88</strong></td>
<td><strong>97</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>14. The best way to remove plaque and debris from a resident’s mouth and teeth surfaces, one can (brush the teeth using a toothbrush and</td>
<td><strong>84</strong></td>
<td><strong>91</strong></td>
<td><strong>91</strong></td>
</tr>
<tr>
<td>15. Poor oral health is NOT related to the health of the body. (T/F)</td>
<td><strong>81</strong></td>
<td><strong>94</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>16. Persons with no teeth (require daily mouth cleaning and denture cleaning).</td>
<td><strong>97</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>17. Toothbrushes can be used until the bristles are worn or frayed. (T/F)</td>
<td><strong>72</strong></td>
<td><strong>78</strong></td>
<td><strong>94</strong></td>
</tr>
<tr>
<td>18. It is acceptable for a resident to wear his/her dentures at night during sleep. (T/F)</td>
<td><strong>72</strong></td>
<td><strong>59</strong></td>
<td><strong>87</strong></td>
</tr>
<tr>
<td>19. Health gums do not bleed when brushed with a toothbrush. (T/F)</td>
<td><strong>87</strong></td>
<td><strong>97</strong></td>
<td><strong>78</strong></td>
</tr>
<tr>
<td>20. Bacterial plaque in the mouth can cause gum disease and tooth decay. (T/F)</td>
<td><strong>97</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

* Significant difference from pre-test, p<.01
4.3 Residents

4.3.1 Demographics

There were 43 residents who consented to participate in control group, with 4 dropouts at the 6-months follow-up, resulting in 39 residents remaining for inclusion in the final data analysis, and 44 residents who consented to participate in the experimental group, with 3 dropouts at the 6-months follow-up, resulting in 41 residents included in the final data analysis. Twenty-three residents in the control group (59%) were females compared with 27 residents in the experimental group (66%). Table 10 shows the results of the participating residents’ demographic information for both groups.

Table 10. Residents' Demographics

<table>
<thead>
<tr>
<th></th>
<th>Control (n=39)</th>
<th>Experimental (n=41)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean  SD  Min  Max</td>
<td>Mean  SD  Min  Max</td>
</tr>
<tr>
<td>Age</td>
<td>79.18  12.2  56  97</td>
<td>80.98  10.67  54  98</td>
</tr>
<tr>
<td># of Teeth</td>
<td>18.92  7.59  6  30</td>
<td>19.95  5.71  5  27</td>
</tr>
</tbody>
</table>

4.3.2 Plaque Index and Gingival Index

Residents in both groups had their modified PI and modified GI taken at baseline and at 6-months follow-up. The results of the PI and GI for both groups can be seen in Table 11.
Table 11. Residents' Plaque Index and Gingival Index

<table>
<thead>
<tr>
<th></th>
<th>Control (n=39)</th>
<th></th>
<th>Experimental (n=41)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>PI Baseline</td>
<td>1.83</td>
<td>0.72</td>
<td>0.17</td>
<td>3.00</td>
</tr>
<tr>
<td>PI Follow-up</td>
<td>1.62</td>
<td>0.83</td>
<td>0.00</td>
<td>2.92</td>
</tr>
<tr>
<td>GI Baseline</td>
<td>1.58</td>
<td>0.77</td>
<td>0.00</td>
<td>3.00</td>
</tr>
<tr>
<td>GI Follow-up</td>
<td>1.40</td>
<td>0.80</td>
<td>0.00</td>
<td>2.83</td>
</tr>
</tbody>
</table>

4.3.2.1 Residents’ age as co-variable

An ANCOVA was conducted to evaluate the effect of the co-variable residents’ age on their 6-months modified PI between control and experimental groups. The results indicated that the co-variable, residents’ age, was not significantly related to their 6-months follow-up modified PI, \( F(1, 77)=.59, p=.45, \) partial \( \eta^2 = .01 \). There was no significant difference in residents’ 6-months modified PI means between control and experimental groups after controlling for their age, \( F(1, 77)=.01, p=.92, \) partial \( \eta^2 = .00 \).

An ANCOVA was conducted to evaluate the effect of the co-variable residents’ age on their 6-months modified GI between control and experimental groups. The results indicated that the co-variable, residents’ age, was not significantly related to their 6-months follow-up modified GI, \( F(1, 77)=1.81, p=.18, \) partial \( \eta^2 = .02 \). There was no significant difference in residents’ 6-months modified GI means between control and experimental groups after controlling for their age, \( F(1, 77)=.21, p=.65, \) partial \( \eta^2 = .00 \).
4.3.2.2 Residents’ number of teeth as co-variable

A similar ANCOVA was conducted to evaluate the effect of the co-variable, residents’ number of teeth, on their 6-months modified PI between control and experimental groups. The results showed that the co-variable, residents’ number of teeth, was not significantly related to their 6-months follow-up modified PI, \( F(1, 77)=3.46, p=.07 \), partial \( \eta^2=.04 \). There was no significant difference in residents’ 6-months modified PI means between control and experimental groups after controlling for their number of teeth, \( F(1, 77)=.03, p=.86 \), partial \( \eta^2=.00 \).

A similar ANCOVA was conducted to evaluate the effect of the co-variable, residents’ number of teeth, on their 6-months modified GI between control and experimental groups. The results showed that the co-variable, residents’ number of teeth, was not significantly related to their 6-months follow-up modified GI, \( F(1, 77)=2.63, p=.11 \), partial \( \eta^2=.03 \). There was no significant difference in residents’ 6-months modified GI means between control and experimental groups after controlling for their number of teeth, \( F(1, 77)=.23, p=.63 \), partial \( \eta^2=.00 \).

4.3.3 PI between groups comparisons

A Two-way ANOVA was conducted to evaluate the mean differences in the modified PI of treatment groups (control vs. experimental residents) between baseline and 6-months follow-up. The results indicated no interaction between time and treatment groups, \( F(1, 156)=.30, p=.58 \), partial \( \eta^2=.00 \). There was no significant difference in the modified PI means between control and experimental groups, \( F(1, 156)=.37, p=.54 \), partial \( \eta^2=.00 \). There was a significant time effect on the modified PI means between baseline and 6-months follow-up within both control and experimental groups, \( F(1, 156)=5.52, p<.05 \), partial \( \eta^2=.03 \). In looking at the modified PI means in Table 11, the plaque levels significantly decreased at 6-months compared to baseline for both control and experimental groups.
4.3.4 GI between groups comparisons

A Two-way ANOVA was conducted to evaluate the mean differences in the modified Gingival Index of control and experimental groups between baseline and 6-months follow-up. The results indicated no interaction between time and treatment groups, $F(1, 156)=.09, \ p=.76, \ partial \ \eta^2=.00$. There was no significant difference in the modified GI means between control and experimental groups, $F(1, 156)=.69, \ p=.41, \ partial \ \eta^2=.00$. There was also no significant time effect on the modified GI means between baseline and 6-months follow-up for both control and experimental groups, $F(1, 156)=3.29, \ p=.07, \ partial \ \eta^2=.02$.

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$^b$ significant at $p<.05$
Chapter 5
Discussion

5 Discussion

This study aimed to evaluate the efficacy of educating support staff to improve the oral health of residents of LTC homes. Two oral hygiene indices, the modified Plaque Index and the modified Gingival Index, were chosen to assess residents’ oral health outcomes. While oral health is determined by consideration of a variety of indicators (e.g. caries, bacterial levels, periodontal status), the level of oral hygiene was chosen to reflect the level of oral health in this population, since changes in bacterial plaque levels often result in changes in gingival health within a short period of time. Furthermore, the PI and GI are validated indices of oral health and have been used in previous studies.

5.1 Personal support workers

PSW participation in this study was low. In some LTC homes, the participation rate was less than 10% of the total number of PSWs employed at that LTC home, and attendance was zero at several mouth care in-services, even though flyer advertisements for the in-services were posted well in advance. This may represent a lack of interest or low-prioritization of mouth care that is similar to previous studies.

In this study PSWs reported “uncooperative residents,” “not enough time,” and “residents’ bad breath” as the most frequently encountered barriers to providing daily mouth care to residents. Wardh et al. in a survey of LTC support staffs’ attitudes towards providing mouth care also discovered that providing daily mouth care was reported to be “very” repulsive. “Uncooperative residents” was also cited as a significant inhibiting factor when providing daily mouth care in a study by Young et al. and Wardh et al. where it was felt that residents did not want to be
helped with daily mouth care. Weeks and Fiske\textsuperscript{118} in a qualitative exploration of support staffs’ views (regarding oral care for LTC residents) reported time constraints and residents’ bad breath as inhibiting factors to providing daily oral care. The barriers cited in this study are similar to those reported in other investigations.\textsuperscript{99,102}

Less than 5% of respondents reported “lack of mouth care supplies” (such as toothbrush, toothpaste, and/or denture brush) as a barrier to providing daily mouth care. This finding is supported by the observation by the principal investigator in this study that all participating residents had their own appropriate and adequate supply of mouth care products, although the presence or absence of mouth care supplies was not officially recorded.

Surprisingly, only 6% of participating PSWs in this study reported “lack of knowledge” regarding mouth care as a barrier. This may reflect a higher learning motivation to acquire mouth care knowledge which may characterize those PSWs who consented to participate in this study. Non-participants’ demographics and characteristics were not measured in this study, making comparisons between these two groups difficult. This is in contrast to the findings by Paulsson et al.\textsuperscript{118} where close to 40% of support staff admitted lack of knowledge regarding various aspects of providing daily mouth care to residents. Weeks and Fiske\textsuperscript{117} also showed that one of the main inhibiting factors to providing daily mouth care was lack of mouth care training and knowledge of oral diseases. In this study the PSWs’ previous mouth care education experience was not explored nor measured. All efforts were made by the principal investigator and the LTC home managers to ensure that participating PSWs did not receive mouth care education from other sources for the duration of the study. However, some PSWs may have received mouth care education prior to this study, or from other sources (such as television news and advertisements), all of which could have contributed to the high pre-test scores.
PSWs’ age was significantly related to their performance on the mouth care knowledge pre-test, with those PSWs over 50 years of age scoring significantly better than those less than 29 years of age. There was also a significant time effect (between pre-test and post-test) on PSWs’ knowledge scores for both control and experimental groups, suggesting that the mouth care education program was successful across the age groups. PSWs’ level of LTC experience was not significantly related to their knowledge test scores.

PSWs on average scored high on their knowledge pre-test (77%) with only a few test items scoring poorly. Sixty-six percent of PSWs thought it was natural to lose one’s teeth at one gets older. Forty-four percent of PSWs did not know the proper denture cleaning technique, and 84% of PSWs still thought it was acceptable to clean dentures with abrasive agents, such as toothpaste or powder bathroom cleansers. The proportions of correct responses to one item regarding denture cleaning (see Table 8: item #6) actually decreased at 6-months to below the baseline level. This may reflect a persistent residual retention of the PSWs’ usual denture cleaning habits. The percentage of correct responses to another item (regarding whether or not it is acceptable for residents to wear their dentures overnight during sleep) decreased after the mouth care education. Perhaps this information was not communicated clearly during the mouth care in-services. Participating PSWs expressed confusion regarding this test item during the Q/A sessions following the education in-services, since some PSWs struggled between doing what they think is right (removing the dentures from the resident’s mouth overnight) and allowing the resident to exercise autonomy (i.e. allowing the residents to wear the dentures during sleep.) Some PSWs commented that often some residents won’t allow their dentures to be removed from their mouths overnight for fear of losing the denture(s). Overall, however, PSWs scored well on the basic concepts of gum disease recognition and prevention. These results are in contrast to those of Simons et al.\textsuperscript{30} whose participants’ baseline knowledge of the basic concepts
of oral health and mouth care for LTC residents was poor. In contrast, Frenkel et al." found that caregivers’ baseline knowledge was somewhat high, at 66%. In this study, all of these test items scores increased after the mouth care education, with the post-test mean of 88%. PSWs’ retention of mouth care knowledge was also high, as there was no significant difference between their post-test mean and their 6-months test mean. These findings are similar to the study by Reed et al." whose LTC support staff had a pre-test score of 67%, and a post-test score of 90%. Paulsson et al’s." investigation of mouth care knowledge of LTC support staff also found good retention after three years.

One of the aims of this study was to evaluate if the implementation of a mouth care program would result in a change in mouth care provision. The investigator of this study did not observe the PSWs on a daily basis during the course of the study to document their mouth care provision behavior, nor was daily mouth care provision documented by the LTC home staff in residents’ charts. This makes it difficult to assess whether changes in the residents modified PI and GI resulted from changes in the PSWs’ mouth care provision or from the residents’ oral self-care. It was noted by the principal investigator that in all the participating residents’ medical charts, there wasn’t a separate section designated to “oral care.” This made it time consuming and often difficult to locate any information relating to residents’ oral care, such as oral soft and hard tissue assessments, recommended treatment, oral related complaints, or residents’ level of oral self-care abilities.

Comparisons between studies of this nature should be interpreted with caution, as there exists no standard oral health/mouth care knowledge test that has been universally accepted by researchers and thus the knowledge tests used are different between studies. Furthermore, the large variation in the level of “entry to practice” education that PSWs receive prior to employment in LTC
homes makes comparisons of PSWs’ mouth care pre-test performance difficult between studies. However, most mouth care education intervention studies, including this study, have shown a significant increase and retention in oral health/mouth care knowledge after the PSWs received the education, regardless of their previous level of education, LTC experience, or age\textsuperscript{,23,24,30,105}

5.2 Residents

Participating residents in this study had a mean number of teeth of 19.95 ($SD=5.7$). This number is slightly higher than those of other studies\textsuperscript{,42,119} Only those residents with teeth were included as participants in this study, since the PI and GI indices are designed for use on dentate subjects. Almost all of the resident-participants were able to give informed consent (as per the study selection criteria). However, the level of physical dependency among resident-participants varied with the result that some participants could physically perform their own daily mouth care, even if their PI and GI may indicate otherwise, while other participants were completely dependent on the support staff for assistance. Residents had a mean age of 80.98 years ($SD=10.7$), which is similar to the mean age of LTC residents in another Canadian study\textsuperscript{46} and other studies in Western countries\textsuperscript{,2,117,119} The ability to perform one’s own oral hygiene is paramount to maintaining optimal oral health. Due to decreased motor skills and/or mental capacities, most residents of LTC homes are unable to perform this task, or do so poorly. As a result the oral health of residents of LTC homes have been described as poor. The oral health of residents in this study, on average, was poor (PI=1.96 ($SD=.61$), GI=1.72 ($SD=.65$)) at baseline, with no significant difference between control and experimental groups at baseline. All resident-participants (with the exception of two) were physically and mentally able to grant their own informed consent to participate in this study. This participation criterion was chosen to hopefully reduce the resistive/combative behaviors often seen in residents with more severe
mental diseases such as Alzheimer’s, Parkinson’s or Dementia. However, the residents in this study had a wide variation in their motor skills and ability to perform oral self-care.

Unfortunately, it is often those residents with reduced mental capacities (and thus couldn’t give informed consent to participate in this study) who often have the worse oral health. Even though some of the resident-participants in this study were capable of (or proclaimed that they were capable of) brushing their own teeth and/or dentures, the modified PI and GI suggest that they do so poorly. Oral examinations revealed many broken teeth, gross caries, and severe periodontal conditions despite residents’ comments that nothing was hurting or bothering them orally.

Clinical exam findings were communicated to either the residents and/or their alternate decision makers (such as a family member), documented in their charts and the appropriate dental treatment referrals were made. At the time of the 6-months follow-up examinations, most of the treatment recommendations were not followed through. There could be several reasons for this low-perceived oral health needs among these residents. Locker et al. suggested a link between overall life satisfaction and oral health self-rating, which might explain residents’ “lack of interest” in their oral health needs in the presence of other general health problems. The low rate of follow-throughs on the dental treatment recommendations could be a result of financial limitations of these residents. In this study, residents’ manual dexterity, medical status, or mental status were not measured. Maupome et al. in a survey of oral disorders of residents of LTC institutions found that chronic systemic diseases and decreased manual dexterity were strongly associated with poorer oral health.

Experimental residents’ modified PI significantly improved from baseline to 6-months, after the PSWs received the mouth care education, similar to Isaksson et al.; however, there was no significant improvement in the modified GI from baseline to 6-months follow-up for both groups. There was no significant difference in mean modified PI and GI at the 6-months follow-
up between control and experimental groups. This phenomenon could be explained in part by the Hawthorne effect. The principal investigator was present in each LTC home for up to two weeks while conducting oral examinations on residents. It is likely that the presence of a dental professional within the control homes for an extended length of time exerted some psychological influence on the mouth care behavior of both PSWs and residents. However, this was not observed or documented. In addition, although PSWs were blinded to their home assignments, they were aware of the aim and methodology of the study and thus were aware of their role throughout the study, mainly that they were responsible for providing daily mouth care to the residents. This could also explain why there was a significant improvement in the modified PI at the 6-month follow-up even though there was no significant improvement in their modified GI. An individual’s plaque level can change immediately following proper mouth care, while their gingival health may take up to four weeks to respond to any changes in the level of plaque. In other words, the presence of the principal investigator at the 6-month follow-up may have encouraged the participants to improve their mouth care activities (thus changing the plaque level) but the modified GI did not have enough time to respond accordingly. Participating residents’ level of mouth care dependency was not measured, with a resulting wide variation in their ability to perform their own mouth care. Although residents were also unaware of their group assignment, the presence of a dental professional conducting oral examinations (and then coming back in six months) might have motivated them to improve their own oral self-care practices. The Hawthorne effect is interpreted by many researchers to be a positive, albeit frustrating, phenomenon. No resident interviews were conducted to assess if they had performed their own mouth care, or if they had received it from their PSW. Furthermore, no daily mouth care documentation protocol was implemented, making it difficult to conclude how the oral
health indices in both groups were achieved. Appendix 10 shows a sample of the oral photographs that were taken as part of this investigation.

5.3 Limitations

5.3.1 Randomization

The LTC homes in this study represented a convenient self-selected sample and were not randomly selected. However, once the LTC homes were recruited they were randomly assigned to either control or experimental groups. The PSWs and resident participants also represented a convenient self-selected sample. It was not possible to perform random assignment of PSWs or residents in each LTC home due to physical and geographical limitations of the LTC settings. For example, once participants were selected within each LTC home it was not possible to randomly assign a particular PSW to care for any of the participating residents since it would have required a rescheduling of other non-participants’ work shifts to accommodate this. This would have required a level of participation to which the LTC homes were not willing to commit. In addition, residents are often used to having the same PSWs caring for them within each LTC home. Random assignment of participating PSWs to residents would have presented undue psychological stress to all participants.

5.3.2 Matching

Participating residents and PSWs were not matched between groups according to their demographics, such as age, number of teeth, or level of LTC experience. However, participating PSWs and residents in each LTC home remained in that home throughout the course of the study.
5.3.3 Blindness

This study employed only a single-blind design, in that participants were blinded to their group assignments. Because there was only one principal investigator, it was not possible for the principal investigator to be blinded to the group assignment. However, the clinical measurements were validated by taking intra-oral photographs of residents’ teeth and conducting inter-rater reliabilities using external clinicians, who were blinded to the residents’ group assignment.

5.3.4 Study sample

Even though LTC home administrators consented to participate knowing that their employed PSWs would have to take time off during working hours to attend the mouth care in-services, it was difficult to encourage the support staff to attend these in-services. Flyers advertising the study and mouth care in-services were posted in staff common areas and bulletin boards well in advance of the in-service dates, and large LTC homes received a minimum of two in-services at various times. However, PSW attendance was low. Some of the reasons stated were that they (the PSWs) “did not know about it,” or they “were too busy and did not have time” to attend, or they “did not want to miss their scheduled break,” or they “already know how to brush the residents’ teeth.” The study sample of PSWs represented approximately only about ten percent of the total number of PSWs employed in all the participating LTC homes. Thus the results of this study have limited generalizability.

Residents often did not want to participate, saying that their teeth were old and did not warrant examination or brushing, or that nothing was bothering them orally. These issues underline the difficulties of participant recruitment within the LTC setting. Residents were not matched between control and experimental groups according to age, number of teeth, oral health needs, or
medical condition. Participating residents were not matched to any specific PSWs (such as those working in evening shifts, when mouth care is expected to be performed). Participants were not observed on a daily basis, nor were their mouth care practices documented for the duration of the study. Thus it was not possible to account for who actually performed the mouth care (i.e. the residents themselves, or the PSWs, or both.)

5.3.5 Mouth care education and knowledge test

The length of the in-services was limited to 60 minutes which was often not enough to satisfactorily cover all the necessary subject areas, since 10 minutes at the beginning and the end of the in-services were reserved for completion of the knowledge tests. It was not possible to increase the in-service time due to challenges in the PSWs’ employment schedules. Sometimes the in-services had to be scheduled during work shift change-over times which meant that PSWs were expected to take time outside of billable working hours to attend education that is related to work.

PSWs’ post-tests were conducted immediately following the mouth care in-services. This was done to maximize the support staffs’ presence since it would have been difficult to locate the same PSWs who took the pre-tests to take the post-tests at a later time. The disadvantage was that there was an expected high carry-over effect since the mouth care knowledge was recently gained. However, this effect was countered by conducting a 6-months follow-up knowledge test.

The knowledge pre- and post-tests were done under the supervision of the principal investigator to ensure independence of responses (i.e. no cheating). However, the 6-month follow-up test was not supervised, in that they were distributed to the participating PSWs with instructions to complete and then returned to the investigator. Therefore, it cannot be concluded with certainty that the participants (PSWs) did not collude to arrive at the correct answers when completing the
6-month follow-up tests. Therefore, while it is encouraging that the participants may have engaged in some degree of interdisciplinary collaboration when completing the 6-month follow-up test, the conclusion that the PSWs successfully retained their mouth care knowledge at 6 months should be interpreted with caution. It should be noted that written educational material relating to mouth care were not distributed to the LTC homes until after the conclusion of the study.
Chapter 6
Conclusion

Personal support workers in this study significantly increased their mouth care knowledge after receiving mouth care education. Their 6-month knowledge was not significantly different from their post-test knowledge. A significant improvement in the modified PI was noted between baseline and 6-months follow-up for both control and experimental residents. However, there was no significant improvement in the modified GI from baseline to follow-up for both control and experimental residents. The results of this study show that mouth care education is effective in improving the mouth care knowledge of LTC support staff; however, because daily mouth care activities were not formally observed or documented, and participating PSWs and residents were not matched during the course of this study, it is not possible to confirm what contribution the mouth care education had in improving the oral health of participating residents.

The limitations encountered in this study highlighted the challenges in ensuring research rigueur in a changing environment. Future research should endeavor to identify and assign participating care givers (such as PSWs) to participating residents. Vital to any interventions to improve residents’ oral health is a comprehensive oral health program that should include individualized oral care plans that reflect the oral care needs of each resident. These oral care plans should be reviewed on a regular basis to assess any changes in the residents’ oral care needs. In addition, the proper documentation and audit of any intervention that is part of the research would enable researchers to assess if the education of support staff contributed directly to any changes in residents’ oral health. Indeed, the identification and involvement of advocates of oral health from within the LTC home organizations would positively contribute to the improvement of residents’ oral health by ensuring the proper administration of any oral health promotion.
program. These advocates can include the head nurse, the social worker, a senior home administrator, or even residents’ family members.
Appendices

Appendix 1. FACILITY INTRODUCTION

Title of Study:  Efficacy of an Oral Health Education Program to Improve Oral Health Status of Residents of Long Term Care Facilities.
Principal Investigator: Phu Le, Master of Science student, University of Toronto. phu.le@utoronto.ca. Tel: 647-210-5773.
Supervisor: Dr. David Locker, Professor, University of Toronto
Sponsor: Community Dental Health Services Research Unit, University of Toronto

Dear Madam/Sir:

Please accept this invitation to participate in this study to evaluate the relationship between CAs' mouth care knowledge and residents' oral health. In this study, the target population will be Personal Support Workers (PSWs) and those residents who rely on them for assistance with oral hygiene.

Introduction

The ability to perform effective oral hygiene is important in maintaining good oral health. However for those individuals who are unable to effectively perform daily oral hygiene, their oral health can quickly deteriorate. The institutionalized elderly, particularly those residing in long term care (LTC) facilities are often affect by physical and/or mental disabilities which can decrease their ability to perform adequate daily oral hygiene. Consequently, these residents must often rely on care staff, such as personal support workers (PSWs) for assistance with daily oral hygiene. However, one of the most significant barriers to good oral health among residents of LTC facilities is lack of knowledge and training regarding mouth care among LTC care staff who provide daily mouth care assistance. Thus the oral health status of residents of LTC facilities has often been described as poor. **The purpose of this study is to evaluate the Efficacy of a Mouth Care Education Program to Improve the Oral Health Status of Residents of Long Term Care Facilities.**

Methods

This study will be carried out in three stages. **The first stage** will be to collect baseline data regarding PSWs’ mouth care knowledge and residents’ oral health status. **The second stage** will involve a series of mouth care in-services (each lasting approximately 60 minutes). More than one in-service will be scheduled throughout a 2 week period in order to accommodate as many PSWs as possible. **The third stage** (at 6 months follow-up) will be to collect data regarding PSWs’ mouth care knowledge and residents’ oral health status.

PSWs’ mouth care knowledge will be assessed via a 20-item knowledge test. The same test will be administered at the 6 months follow-up. The knowledge test will take approximately 15 minutes to complete. Residents’ oral health status will be assessed via visual oral examinations using a periodontal probe, intra-oral mirror, and portable light. These oral examinations can be done in a special designated room or in cases where the resident is immobile, at bedside in the
These oral examinations will occur at baseline and at 6 months. Each examination will take approximately 15 to 20 minutes.

Overall, PSWs will only need approximately 90 minutes to complete the first stage of the study (attendance at the in-service and completion of knowledge test), and approximately 20 minutes to complete the third stage of the study (knowledge test only). Each oral examination will take approximately 20 minutes of the resident’s time.

Voluntary Participation

Participation in this study is on a voluntary basis. As participants, you can freely withdraw from the study at any time during the study, for any reason, without negative consequence.

Risks

There are minimal risks associated with participation in this study. The oral examination is visual in nature, using measurement methods that require minimal soft tissue invasion. The resident will only feel slight pressure from the instruments used to assess plaque levels and soft tissue health, such as the mouth-mirror. With the resident’s permission, their medical charts will be reviewed only for the purpose of identifying any medical contra-indications to receiving oral examinations, or alternately the medical director or head nurse will be consulted regarding residents' potential eligibility. The findings of this study will be presented as group data and no individual PSW, resident, or facility will be identified by name or location.

Benefits

For PSWs, this study will provide an opportunity for knowledge gain or review regarding mouth care. For those PSWs unable to attend the in-service or participate in the study, a copy of the in-service (either video or CD-rom) will be made available at the facility for viewing.

For residents, this study will provide an opportunity for a quick evaluation of their oral health status. Any dental treatment needs arising from the examination will be communicated to the resident, and a list of local dental professionals will be provided. Residents will have the right to refuse any recommended treatment, or chose their own dental professionals for treatment.

Privacy & Confidentiality

Participants’ and facilities’ privacy and confidentiality will be guaranteed to the extent permitted by law. All raw data collected will be kept in a secure location and in a locked metal cabinet, when not being used by the investigators. Processed data will be stored electronically in a computer accessible only by a secret password belonging to the principal investigator. Data will also be stored in a secondary portable storage device for safeguard in the event that the original data are lost or destroyed. Only the investigators of this study will have access to the data collected from this study. PSWs’ Knowledge tests will be initially identified by name, in combination with a randomly assigned code, for the purpose of data linkage (since more than one test will be taken by each PSW participant), but at the end of the study, the names will be stripped from the tests leaving only the codes as identifiers. Residents’ oral health findings will be identified by randomly assigned codes and not by name. Findings from this study will be
reported as group data and no individual PSW, resident, or facility will be identified by name or location. The findings of this study will be made freely available to all participants.

**Your Rights as Participants**

You have the right to decline or withdraw consent to participate in this study at any time without negative consequence. Refusing to sign the consent form, or verbally communicating your wish to withdraw from the study will be sufficient indication of your withdrawal from the study. You have the right to enquire further about the study with the investigator. You have the right to freely contact the University of Toronto's Office of Research Ethics at 416-946-3273, or ethics.review@utoronto.ca if I have any questions regarding your rights as participants in this study.
Appendix 2. FACILITY’S CONSENT

**Principal Investigator:** Phu Le, Tel. 647-210-5773, phu.le@utoronto.ca, University of Toronto  
**Co-Investigator:** Dr. David Locker, University of Toronto

I give consent for this facility to participate in the study, **Efficacy of an Oral Health Education Program to Improve Oral Health Status of Residents of Long Term Care Facilities.**

I understand that this study includes oral health presentations (in-services) by the investigators which will take about 60 minutes per presentation. The study will also include voluntary participation by personal support workers (PSWs), and also any direct care providers who wish to attend the in-services.

I understand that residents who are eligible and have consented to participate will receive 2 oral health examinations, one at baseline, and one at 6 months. The examinations will take place in a designated room within the facility using portable dental equipment provided by the investigators. Immobile residents will be examined at bedside in the resident's room.

I understand that all information collected from this study will be handled with the highest standard of confidentiality, including storage in a locked metal cabinet, in a secure office to which only the principal investigator will have access. Any scientific reports arising from this study will be reported as group data and no individual facility or participant will be identified by name or location.

I understand I can freely decline, or withdraw consent, to participate in this study at any time without negative consequence to myself or the facility.

The purpose and methods of the study have been explained to me by the investigators, and I may ask additional questions at any time by contacting the investigators, either by telephone, and/or electronic email. Dr. Locker's telephone # is 416-979-4900 x4490. Mr. Phu's telephone # is 647-210-5773, and email address is phu.le@utoronto.ca. I can contact the University of Toronto's Office of Research Ethics at 416-946-3273, or ethics.review@utoronto.ca if I have any questions about my rights as participants in this study. I have been given a copy of this consent form for my own records.

**AUTHORIZATION**

I, ___________________________, have read and understood the purpose and methods of this study, and have consented to participate in this study. My signature indicates my consent to allow the data gathered from this study to be used in research journals, books, or teaching materials, without identifying me, this facility, or any participants.

*Administrator's signature:* ___________________________  *Date:* ________________

*Witness' name:* ___________________________

*Witness' signature:* ___________________________  *Date:* ________________
Appendix 3. PERSONAL SUPPORT WORKER’S INTRODUCTION

Title of Study:  Efficacy of an Oral Health Education Program to Improve Oral Health Status of Residents of Long Term Care Facilities.
Main Investigator:  Phu Le, Master of Science student, University of Toronto, 647-210-5773, phu.le@utoronto.ca.
Supervisor:  Dr. David Locker, Professor, University of Toronto
Sponsor:  Community Dental Health Services Research Unit, University of Toronto

Dear Madam/Sir:

Please accept this invitation to participate in this study to evaluate the relationship between PSWs' mouth care knowledge and residents' oral health. You have been selected to participate in this study because, as personal support workers (PSWs), you provide assistance to residents with the majority of residents’ Activities of Daily Living. The following sections will explain the purpose of the study and the extent of your participation. Thank you.

Introduction

The ability to perform effective oral hygiene is important in maintaining good oral health. However for those individuals who are unable to effectively perform daily oral hygiene, their oral health can quickly deteriorate. The institutionalized elderly, particularly those residing in long term care (LTC) facilities are often affected by physical and/or mental disabilities which can decrease their ability to perform adequate daily oral hygiene. Consequently, these residents must often rely on care staff, such as personal support workers (PSWs) for assistance with daily oral hygiene. However, one of the most significant barriers to good oral health among residents of LTC facilities is lack of knowledge and training regarding mouth care among LTC care staff who provide daily mouth care assistance. Thus the oral health status of residents of LTC facilities has often been described as poor. The purpose of this study is to evaluate the relationship between PSWs’ knowledge regarding mouth care and the oral health status of those residents who must rely on these PSWs for assistance with daily mouth care.

Methods

This study will be carried out in three stages. **The first stage** will be to collect baseline data regarding PSWs’ mouth care knowledge and residents’ oral health status. **The second stage** will involve a series of oral health in-services (each lasting approximately 60 minutes). More than one in-service will be scheduled throughout a 2 week period in order to accommodate as many PSWs as possible. Then there will be a post-intervention knowledge test. **The third stage** (at 6 months follow-up) will be to collect data regarding PSWs’ mouth care knowledge and residents’ oral health status.

The mouth care knowledge will be assessed via a 20-item knowledge test. The same test will be administered at the beginning of the study and at the 6 months follow-up. The knowledge test will take approximately 15 minutes to complete. Overall, you will only need approximately 90 minutes to complete the first stage of the study (attendance at the in-service and completion of knowledge tests), and approximately 20 minutes to complete the third stage of the study (knowledge test only).
Voluntary Participation

Participation in this study is on a voluntary basis. As participants, you can freely withdraw from the study at any time during the study, for any reason, without negative consequence. You may also view the Oral Health Education Program in-service without being a participant in this study.

Risks

There are minimal risks associated with participation in this study. The results of this study will be reported at group data. You will not be identified in any way. Doing poorly on the knowledge test will not negatively affect you in any way. Only you will have access to your personal information, including test results.

Benefits

The Oral Health Education Program is designed to provide information and strategies for mouth care provision in the LTC setting. There is an opportunity to gain new and valuable knowledge, or refresh existing knowledge regarding oral health and mouth care provision. You will also have an opportunity to clarify any confusion you may have regarding oral health and mouth care provision.

Privacy & Confidentiality

Your confidentiality will be guaranteed to the extent permitted by law. All raw data collected will be kept in a secure location and in a locked metal cabinet, when not being used by the investigators. Processed data will be stored electronically in a computer accessible only by a secret password belonging to the principal investigator. Data will also be stored in a secondary portable storage device for safeguard in the event that the original data are lost or destroyed. Only the investigators of this study will have access to the data collected from this study. Your knowledge tests will be initially identified by name, in combination with a randomly assigned code, for the purpose of data linkage (since more than one test will be taken by each PSW-participant), but at the end of the study, the names will be stripped from the tests leaving only the codes as identifiers. Findings from this study will be reported as group data and no individual PSW, resident, or facility will be identified by name or location.

Your Rights as Participants

You have the right to decline or withdraw consent to participate in this study at any time without negative consequence. Refusing to sign the consent form, or verbally communicating your wish to withdraw from the study will be sufficient indication of your withdrawal from the study. You have the right to enquire further about the study with the investigator. You have the right to freely contact the University of Toronto's Office of Research Ethics at 416-946-3273, or ethics.review@utoronto.ca if I have any questions regarding your rights as participants in this study.
Appendix 4. PERSONAL SUPPORT WORKER'S CONSENT

**Principal Investigator:** Mr. Phu Le, Tel. 647-210-5773, phu.le@utoronto.ca. University of Toronto.

**Co-investigator:** Dr. David Locker, Professor, University of Toronto

I, ____________________________, consent to participate in this study to evaluate the **Efficacy of an Oral Health Education Program to Improve Oral Health Status of Residents of Long Term Care Facilities.**

I understand that I am not obligated to participate in this study. In addition, I can freely withdraw from the study at any time without consequence to my current employment.

I understand that the investigators will maintain the highest standard to protect my identity and the data collected from this study, including keeping the information under lock and key at a location only accessible to the investigators, and that I will be identified by a randomly assigned code, known only to the investigators.

I understand that data from this study will be reported only as group data and that no individuals, including myself, will be identified by name. I also have the right to view information regarding myself gathered from this study.

My participation in this study is voluntary. I have not received, nor will I receive any financial compensation for my participation in this study.

This study has been fully explained to me. I am free to request more information about the study by contacting the investigators by any means that I am accustomed to. I have been provided with the investigators' contact information. Dr. Locker's telephone # is 416-979-4900 x4490. Mr. Phu Le's telephone # is 647-210-5773. Mr. Phu Le’s email address is phu.le@utoronto.ca. I may also contact the University of Toronto's Office of Research Ethics at 416-946-3273, or ethics.review@utoronto.ca to enquire regarding my rights as a participant in this study. I have been provided with a copy of this consent form for my own records.

**CARE AIDE’S CONSENT**

Care Aide's Name: ____________________________ Date:________________________

Care Aide's Signature:__________________________

Witness' Name:______________________________ Date:________________________

Witness' Signature:____________________________
Appendix 5. RESIDENT’S INTRODUCTION

Title of Study: Efficacy of an Oral Health Education Program to Improve Oral Health Status of Residents of Long Term Care Facilities.
Main Investigator: Phu Le, Master of Science student, University of Toronto
Tel. 647-210-5773, phu.le@utoronto.ca.
Supervisor: Dr. David Locker, Professor, University of Toronto
Sponsor: Community Dental Health Services Research Unit, University of Toronto

Dear Madam/Sir,

Please accept this invitation to participate in this study to evaluate the relationship between care providers’ mouth care knowledge and residents’ oral health status. You have been invited to participate in this study because you might benefit from the changes in mouth care knowledge of the care providers who assist you with daily mouth care.

Introduction

The ability to perform effective oral hygiene is important in maintaining good oral health. However for those individuals who are unable to effectively perform daily oral hygiene, their oral health can quickly deteriorate. The institutionalized elderly, particularly those residing in long term care (LTC) facilities are often affect by physical and/or mental disabilities which can decrease their ability to perform adequate daily oral hygiene. Consequently, these residents must often rely on care staff, such as personal support workers (PSWs) for assistance with daily oral hygiene. However, one of the most significant barriers to good oral health among residents of LTC facilities is lack of knowledge and training regarding mouth care among LTC care staff who provide daily mouth care assistance. Thus the oral health status of residents of LTC facilities has often been described as poor. The purpose of this study is to evaluate the efficacy of a mouth care education program to improve the oral health status of residents of long term care facilities.

Methods

This study will be carried out in three stages. The first stage will be to collect baseline data regarding PSWs’ mouth care knowledge and residents’ oral health status. The second stage will involve a series of mouth care in-services (each lasting approximately 60 minutes). More than one in-service will be scheduled throughout a 2 week period in order to accommodate as many PSWs as possible. The third stage (at 6 months follow-up) will be to collect data regarding PSWs’ mouth care knowledge and residents’ oral health status.

You will receive 2 oral examinations, one at the beginning of the study, and one at the end of the study (6 months later), to assess your oral health status. These examinations are visual in nature with minimal discomfort. These examinations are done with a mouth mirror, and a portable light source. You will be informed of the results of your oral examinations. You will be informed of any tooth decay or infections that require immediate attention. You will also be provided with a list of local dentists or dental hygienists who can provide any dental treatment that you might need. You can choose to use this list or seek your own dental professional for any recommended treatment. There will be photos taken of the inside of your mouth. These pictures will only
include the retracted lips, teeth, and gums and will not identify you in any way. These pictures will only be identified by a randomly assigned code matching the code on your oral health assessments. Each oral examination will take approximately 30 minutes to complete.

**Voluntary Participation**

Participation in this study is on a voluntary basis. As participants, you can freely withdraw from the study at any time during the study, for any reason, without negative consequence.

**Risks**

There are minimal risks associated with participation in this study. The oral examination is visual in nature, using measurement methods that require minimal soft tissue invasion. You will only feel slight pressure from the instruments used to assess plaque levels and soft tissue health, such as the mouth-mirror. **With your permission, your medical charts will be reviewed only for the purpose of identifying any medical contra-indications to performing the oral examinations.** Alternately, the medical director or head nurse can be consulted regarding your participation eligibility. No medical data will be extracted or recorded from your medical chart. You will only be identified as either “eligible,” or “ineligible” to participate in this study. The findings of this study will be presented as group data and you will not be identified by name or location.

**Benefits**

This study will provide you with an opportunity to receive two free oral examinations to determine your oral health status. Any dental treatment needs arising from the examinations will be communicated to you, and a list of local dental professionals will be provided. You have the right to refuse any recommended treatment, or chose your own dental professionals for treatment.

**Privacy & Confidentiality**

Your privacy and confidentiality will be guaranteed to the extent required by law. All raw data collected will be kept in a secure location and in a locked metal cabinet. Processed data will be stored electronically in a computer accessible only by a secret password belonging to the principal investigator. Data will also be stored in a secondary portable storage device for safeguard in the event that the original data are lost or destroyed. Only the investigators of this study will have access to the data collected from this study. Your oral examinations will be initially identified by name, in combination with a randomly assigned code, for the purpose of data linkage (since more than one oral examination will be performed on you throughout the study), but at the end of the study, your name will be stripped from the examinations leaving only the codes as identifiers. **Findings from this study will be reported as group data and you will not be identified by name or location. The findings of this study will be made freely available to all participants.**
Your Rights as Participants

You have the right to decline or withdraw consent to participate in this study at any time without negative consequence. Refusing to sign the consent form, or verbally communicating your wish to withdraw from the study will be sufficient indication of your withdrawal from the study. You have the right to enquire further about the study with the investigator. You have the right to freely contact the University of Toronto Office of Research Ethics at 416-946-3273, or ethics.review@utoronto.ca if I have any questions regarding your rights as participants in this study.
Appendix 6. RESIDENT'S CONSENT

**Principal Investigator**: Mr. Phu Le, University of Toronto, Tel. 647-210-5773, phu.le@utoronto.ca.

**Co-investigator**: Dr. David Locker, Professor, University of Toronto

I, __________________________, consent to participate in this study to evaluate the **Efficacy of an Oral Health Education Program to Improve Oral Health Status of Residents of Long Term Care Facilities**.

The purpose of this study and its methods have been fully explained to me and I understand that as part of the study, my mouth will be examined on two (2) occasions throughout the study by a licensed dental professional. These examinations will be visual in nature and will require approximately 20 minutes each. These examinations are meant to assess my level of oral health. I also understand that there will be pictures of my mouth taken by the investigator as part of this study.

I understand that I will be requested to open my mouth for these oral examinations. If necessary, the principal researcher will gently pull back my lips (using gloved fingers or a mouth mirror) to reveal the inside of my mouth for better viewing and for the taking of the pictures. A portable light source will be used to illuminate the inside of my mouth for better inspection. The level of plaque and health of my gums is performed by visual inspection with minimal instrumentation.

I understand that my medical records will be reviewed by the principal researcher, or that the medical director or head nurse will be consulted, only for the purpose of determining my medical eligibility to receive oral examinations that are part of this study.

I understand that I will be informed of my oral health status, and that the investigators will advise me regarding any treatment that I may need, and provide a list of dental professionals in the community for follow-up care. I understand that I may refuse any recommended treatment, or chose to seek my own alternate routes of treatment through my own dental professional.

I understand that I am not obligated to participate in this study. In addition, I can freely withdraw from the study at any time without consequence to my residence at the facility or the care I receive either now or in the future.

I understand that the investigators will maintain the highest standard of confidentiality to protect my identity and the data collected from this study, including keeping the information under lock and key at a location only accessible to the investigators, and that I will be identified by a randomly assigned code known only to the investigators.

I understand that I have the right to view any information regarding myself gathered from this study, and that data from this study will be reported only as group data. I will not be identified by name.

My participation in this study is voluntary. I have not received, nor will I receive any financial compensation for my participation.
This study has been fully explained to me. I am free to request for more information about the study by contacting the investigators by any means that I am accustomed to. I have been provided with the investigators' contact information. Dr. Locker's telephone # is 416-979-4900 x4490. Mr. Phu Le's telephone # is 647-210-5773, and email contact is phu.le@utoronto.ca. I may also contact the University of Toronto's Office of Research Ethics at 416-946-3273, or ethics.review@utoronto.ca to enquire regarding my rights as a participant in this study. I have been given a copy of this consent form for my own records.

RESIDENT CONSENT

Resident's Name: _____________________ Date: ____________

Resident's Signature: ______________________________

Guardian's Name (if necessary):___________________ Date: ____________

Guardian's Signature: ______________________________

Witness' Name: ________________________________ Date: ____________

Witness' Signature: ______________________________


Appendix 7. PLAQUE INDEX

This index was first proposed in 1964 by John Silness and Harald Loe as a way to measure the state of oral hygiene in subjects by assessing the amount of soft deposits (dental plaque) on certain teeth surfaces. The location of these teeth is prescribed and missing teeth are not substituted. The following table describes the scoring system used in the Plaque Index.

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No plaque.</td>
</tr>
<tr>
<td>1</td>
<td>A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen <em>in situ</em> only after application of disclosing solution or by using the probe on the tooth surface.</td>
</tr>
<tr>
<td>2</td>
<td>Moderate accumulation of soft deposits within the gingival pocket, or on the tooth and gingival margin which can be seen with the naked eye.</td>
</tr>
<tr>
<td>3</td>
<td>Abundance of soft matter within the gingival pocket and/or the tooth and gingival margin</td>
</tr>
</tbody>
</table>


Each selected tooth is given 4 surfaces (buccal, lingual, mesial, and distal), with each surface given a score (0 to 3) according to the scoring system described above. The scores from the 4 surfaces are summed and divided by 4 to give the Plaque Index for that tooth. The Plaque Index score for the entire mouth is obtained by adding the individual scores of each tooth surface and then dividing that total score by the number of teeth measured. Thus the Plaque Index for a given subject is the average plaque score of the total number of teeth surfaces measured.
Appendix 8. GINGIVAL INDEX

The Gingival Index (GI) was first proposed in 1963 by Harald Loe and John Silness as a way to score the different grades of gingival (gum) inflammation. The GI assigns numerical scores to describe the level of inflammation around a prescribed set of teeth with the mouth. These teeth are the same teeth used in the Plaque Index. The Gingival Index and Plaque Index are often used together to assess the level of oral hygiene of an individual, since the level of plaque on the teeth and adjacent to the gingival margin often results in inflammation of the gums adjacent to those teeth. The following table describes the Gingival Index scoring system.

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absence of inflammation</td>
</tr>
<tr>
<td>1</td>
<td>Mild inflammation – slight change in color and little change in texture</td>
</tr>
<tr>
<td>2</td>
<td>Moderate inflammation – moderate glazing, redness, edema, and hypertrophy (swelling). Bleeding upon pressure.</td>
</tr>
<tr>
<td>3</td>
<td>Severe inflammation – marked redness and hypertrophy. Tendency to spontaneous bleeding. Ulceration.</td>
</tr>
</tbody>
</table>


The gingiva (gums) adjacent to the set of prescribed teeth are examined at 4 areas (buccal, lingual, mesial, distal). A score between 0 and 3 is given to each area according to the scoring system described above to represent the level of inflammation of that area. The score for the 4 areas around a tooth is obtained by adding up the 4 scores of that area and then dividing by 4. Likewise, the final GI score for a patient (subject) is obtained by summing all the scores for the areas examined and then dividing by the number of corresponding teeth.
Appendix 9. MOUTH CARE KNOWLEDGE TEST
Name ____________________________

----------------------------------
Code _________

Mouth Care Survey

Part A

The following section will collect demographic information for descriptive purposes. Please answer the following questions by checking the best choice that applies to you.

1. Please indicate your age according to the following categories:

   ___ 19 years old and younger
   ___ 20 to 29 years old
   ___ 30 to 39 years old
   ___ 40 to 49 years old
   ___ 50 years and older

2. Please indicate your gender:

   ___ Male
   ___ Female
   ___ Other

3. Please indicate your years of experience working in a long term care setting:

   ___ 0 to 4 years
   ___ 5 to 10 years
   ___ 11 to 20 years
   ___ More than 20 years

4. How many residents do you provide care for per shift at this facility? _________

5. What problems or barriers do you encounter when providing mouth care to residents? (Check as many items that apply)

   ___ I encounter NO problems or barriers
   ___ Not enough time to provide mouth care
   ___ Uncooperative resident
   ___ Resident’s bad breath
   ___ Do not know how to provide mouth care
   ___ There are no supplies, such as toothbrush and toothpaste
   ___ Other. Please specify _______________________________________________
Part B

For the following test items, please circle the most appropriate choice provided.

1. It is natural to lose your teeth as you get older. T / F

2. It is normal for healthy gums to bleed when brushed with a toothbrush. T / F

3. Gum disease can be prevented by daily removal of plaque and food debris from teeth, gums, and dentures. T / F

4. Providing mouth care is not important, especially when time is limited. T / F

5. The BEST way to treat “dry mouth” is …
   a) provide frequent sips of juice to moisten the mouth.
   b) provide frequent sips of water to moisten the mouth.
   c) give the resident a sugar candy to put in his/her mouth.
   d) do nothing.

6. Dentures SHOULD be cleaned and brushed over a sink filled with water. T / F

7. The BEST time to clean a resident’s mouth is at night before bedtime. T / F

8. Persons with full dentures do not need daily mouth cleaning. T / F
9. Dentures **SHOULD** be cleaned by …
   a) brushing the denture using liquid soap and water.
   b) brushing the denture using an abrasive cleanser such as Ajax or Comet.
   c) soaking the denture in bleach.
   d) none of the above.

10. Tooth loss is **NOT** a natural part of ageing.  T / F

11. To prevent bad breath, gum disease, and tooth decay, plaque and food debris should be removed from the teeth, mouth and dentures …
   a) once a week.
   b) 2 times a week.
   c) every day.
   d) only when the resident requires it.

12. **Healthy** residents living in the same room can share toothbrushes…
   a) when there aren’t enough toothbrushes to go around.
   b) only on certain days of the week.
   c) residents should never share their toothbrushes with other residents, under any situation.
   d) when the head nurse says it is OK to do so.

13. The health of the mouth is related to the health of the body.  T / F
14. The **BEST** way to remove plaque and food debris from a resident’s mouth and teeth surfaces, one can …

   a) rinse the mouth with an over-the-counter mouthwash.
   b) brush the teeth and mouth using a toothbrush with toothpaste.
   c) brush the teeth using a foam-tipped tooth swab (toothette).
   d) rinse the mouth with an over-the-counter mouthwash for at least 10 minutes.

15. Oral health is **NOT** related to the health of the body.  

16. Persons with no teeth …

   a) require daily mouth cleaning and denture cleaning.
   b) require mouth cleaning only once a week.
   c) do not require mouth cleaning, since there are no teeth.
   d) only require mouth cleaning before family visiting time.

17. Toothbrushes should be changed when the bristles are worn or frayed.  

18. It is acceptable for a resident to wear his/her dentures at night during sleep.  

19. **HEALTHY** gums **do not bleed** when brushed with a tooth brush.  

20. Bacterial plaque in the mouth can cause gum disease and tooth decay.
Appendix 10. ORAL PHOTOGRAPH SAMPLE
References


